Preliminary Results of Noise Monitoring in 1995 in Bryce Canyon National Park

Dan A. Foster and Richard M. Bryant

National Park Service

Bryce Canyon National Park

Bryce Canyon, Utah 84717

Abstract: Visitation to national parks continues to increase and the use of aircraft to view scenic wonders is widely popular, but may degrade natural quiet. We conducted surveys from 30 May to 31 August 1995 at five sites using the 15-second Leq Method. Sound levels from helicopters, planes, jets, and other mechanical means, as well as natural or background noise were monitored.

Key words: Noise, aircraft, overflight, monitoring.

Introduction

Visitation to Bryce Canyon National Park by the general public continues to increase on a yearly basis. Impacts from visitation are coming in a variety of ways, but park management has become increasingly aware that noise from mechanical sources, particularly aircraft, has the potential to undermine the natural quiet the park has been noted for.

Use of aircraft to travel to, and view Bryce Canyon National Park has been an option almost from the park's inception. Even before the park was created in the early 1920's, a U.S. Forest Service plan for development included location of a suitable site for "Aeroplane landing" (Scrattish 1985). By the mid 1930's the development of an airport just two miles north of the park was underway and the emergency landing strip with a hanger was completed by 1937 under the combined efforts of the Work Projects Administration, Civilian Conservation Corps, and Garfield County (G. Pollock, Bryce Canyon Airport, personal communication).

In 1977 a private corporation, based immediately north of the park, began offering helicopter and fixed wing tours of the park and region (P. Cox, Bryce Canyon, Utah, personal communication).

In 1995 park staff began a program to monitor noise levels throughout the park. Purposes of the study were to aid in the establishment of baseline data on natural quiet and noise source types within the park, the percent of time these are heard, and the noise equivalent levels (Leq) in decibels.

METHODS

The project was coordinated by the Division of Resource Management staff at Bryce Canyon National

Park. Surveyors were volunteers and park staff.

Five sites were established for monitoring noise from low to high elevation and include canyon rim and backcountry locations. (Figure 1.) Equipment and training were obtained from the Washington Office of the National Park Service.

Equipment protocols, monitoring procedures, and spreadsheet analysis were derived from Selecting a Simplified Method for Acoustic Sampling of Aircraft and Background Sound Levels in National Parks (Miller, Sanchez and Anderson 1995). The equipment used was a tripod mounted CEL 269 Sound Level Meter with wind screen and CEL 282 calibrator. The monitor provided measurement of sound levels from 30 to 100 decibels. This equipment is easy to use in that there are few steps for setup and operation. Before and after calibrations provided efficient means to ensure proper equipment function. A digital readout wind meter was also used to determine wind speed.

The procedure used is described as the 15-second Leq method. A log sheet was used to annotate the noise "equivalent" level (Leq) in decibels for every 15 seconds over a one hour time period. The Leq was coded as the sound source the observer heard at the end of each 15 second time period. The sound source was determined by a hierarchy. If an aircraft was heard, then it was recorded on the data sheet at the level

indicated on the monitor. If no aircraft was heard, but other human sounds were audible, then an "other-human" annotation was made. If no mechanical noise was heard, then natural sound was noted at the appropriate level.

Four sites were monitored for thirteen hours, while the Agua Canyon site was monitored for twelve hours due to lack of personnel time. We varied the monitoring hours and days of the week, to sample across daylight hours and days. No monitoring was undertaken if winds of 10 miles per hour or greater were experienced.

Each Leq column on the data sheets were tabulated and the results were entered into an associated spreadsheet that converts the totals into aircraft noise doses. From the spreadsheet calculations the following information is obtained: 1) percent of time aircraft is audible; and 2) Leq for aircraft noise.

RESULTS

After sixty-four hours of monitoring at the five selected sites we found that parkwide, aircraft could be heard an average of 18.82 percent of the time with a standard deviation of 7.31. Table 1 presents the percent of time aircraft are heard at each site with accompanying standard deviations. For the purposes of this study, we defined helicopters as any rotary aircraft. Planes were fixed wing, low altitude

aircraft. Jets were high altitude aircraft. A graph representation of the same information is presented in Figure 2, with the sites listed in a north to south orientation from left to right.

Average Leq levels for aircraft minus background noise were 36.41 decibels with a standard deviation of 3.14. Table 2 depicts the Leq in decibels for each site with an associated breakdown into helicopters, planes, and jets. Again, Figure 3 presents the same information in a graph format.

DISCUSSION

In a north-south orientation of the sites, it is clear that the sites in the north experience the greatest amount of overflight and therefore noise. These sites are not only closer to the airport and helicopter pad, but also lie closer to flight patterns for optimal viewing of the main amphitheater and geologic formations of the park.

There are many factors affecting the sound levels from aircraft. Some of these include: 1) aircraft height; 2) slant distance of the aircraft to the hearer; 3) atmospheric absorption and aircraft source spectra; 4) attenuation due to intervening hills and heavily wooded areas; 5) attenuation of ground or ground cover that softens noise levels such as grassland; and 6) how the sound of the aircraft is

defined, such as total sound exposure, duration, or the maximum sound (Anderson and Horonjeff 1992). The methods of this study utilized the maximum sound level, in decibels, recorded by the monitor during aircraft flyby.

Because the equipment used for this study would not measure noise below 30 decibels we were relegated to use other studies for ambient or background noise levels. During the late 1970's, monitoring of noise levels within the park was conducted in conjunction with a proposed open pit coal mine near the park. During the day, in absence of strong winds, ambient sound levels frequently fell below 20 decibels. This is comparable to sound levels experienced in high quality recording studios (Foch and Oliver 1980).

The vast majority of helicopter overflights in the park are from the private concession located just outside the park to the north. This service provides visitors a unique view of the park and the geology not obtainable from the ground. Of the complaints received at the park, the most common are concerning helicopter noise and overflight. These complaints generally come from visitors who have made an effort to seek the solitude and quiet of backcountry areas. Although this study shows that helicopter overflights create a deterioration of natural quiet for the time they are heard, a significant amount of the aircraft noise heard

is generated by jet and plane traffic. Jet and plane traffic may be "tuned out" by the general public and accepted as part of the normal spectrum of noise, as we receive few complaints concerning these. It is also of interest to note that the areas where the solitude experiences are probably best experienced are the areas where the helicopter overflight and noise levels are the least.

The fixed wing overflights are from two primary sources. First, are the scenic and sightseeing flights bringing visitors to the airport. These include single and twin engine aircraft with a capacity of a few to about twenty passengers. The second group are the private aircraft flying to the area. In the fall of 1995, the Federal Aviation Administration changed the Bryce Canyon Airport designation from General Aviation to Commercial due to increased use of the airport facilities. As of mid-November 1995, it was estimated that 1200 aircraft had landed at the airport during the year. Use of the airport is projected to increase at an annual rate of between twelve and fifteen percent, from both scenic tours and private aircraft, based on recent trends (G. Pollock, Bryce Canyon Airport, personal communication).

Although there have been, and are now, many users for the airstrip at Bryce Canyon, the original designation was for an emergency landing strip for

commercial aircraft. The park and surrounding area lie under some of the busiest commercial air traffic flyways in the country. These include, but are not limited to: 1) Las Vegas, Nevada to Denver, Colorado; 2) Salt Lake City, Utah to Phoenix, Arizona; 3) San Francisco, California to Denver, Colorado; and 4) Los Angeles, California to Denver, Colorado. This understanding provides a more complete picture as to the levels of noise experienced in the park by commercial jets.

This research provides a better understanding of the types of noise occurring in the park, the amount of time non-natural noise occurs, and will help establish baseline data to aid park managers in working with impacts degrading "natural quiet" within the park and area. The potential increase in aircraft traffic may have serious impacts to this valuable natural resource.

Acknowledgments

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LITERATURE CITED

Anderson, G. S. and R. D. Horonjeff. 1992. Effect of aircraft altitude upon sound levels at the ground. Harris Miller Miller & Hanson, Inc. Report No.

290940.02. 63 pp.

Foch, J. D. and G. S. Oliver. 1980. Technical report on sound levels in Bryce Canyon National Park and the noise impact of the proposed Alton coal mine. Noise Technical Assistance Center, University of Colorado. Boulder, Colorado. 137 pp.

Miller, N. P., G. Sanchez and G. S. Anderson. 1995. Selecting a simplified method for acoustic sampling of aircraft and background sound levels in national parks. Harris Miller Miller & Hanson, Inc. Report No. 290940.24. (Draft) 39 pp.

Scrattish, N. 1985. Historic resource study; Bryce Canyon National Park. National Park Service, Rocky Mountain Regional Office, Denver, Colorado. 253 pp.

Table 1. Percent of time aircraft heard at monitoring sites.

	Fairyland	Water Tanks	Swamp Canyon	Agua Canyon	Bristlecone
Combined aircraft	29.2 (18.8)	19.3 (15.3)	21.8 (9.9)	12.4 (7.2)	11.4 (6.5)
Jet	13.1 (14.2)	11.9 (8.6)	13.4 (8.0)	8.6 (5.6)	9.9 (5.6)
Helicopter	11.5 (11.9)	3.5 (4.7)	5.5 (7.1)	2.7 (5.8)	1.0 (3.5)
Plane	4.2 (3.4)	3.8 (3.7)	3.1 (3.3)	1.2 (1.5)	0.6 (2.1)

(Numbers in parenthesis are the standard deviations for the decibel levels)

Table 2. Average noise levels of aircraft at monitoring sites.

	Fairyland	Water Tanks	Swamp Canyon	Agua Canyon	Bristlecone
Combined aircraft	40.1 (4.7)	33.7 (6.9)	38.2 (5.5)	36.0 (8.1)	33.4 (4.9)
Jet	28.1 (9.9)	31.5 (6.0)	32.8 (4.2)	28.6 (11.1)	32.5 (4.3)
Helicopter	33.5 (15.7)	14.6 (16.0)	21.2 (20.0)	10.6 (18.3)	3.6 (9.4)
Plane	23.4 (13.5)	20.2 (16.1)	17.2 (16.3)	10.4 (12.8)	4.8 (11.7)

(Numbers in parenthesis are the standard deviations for the decibel levels)

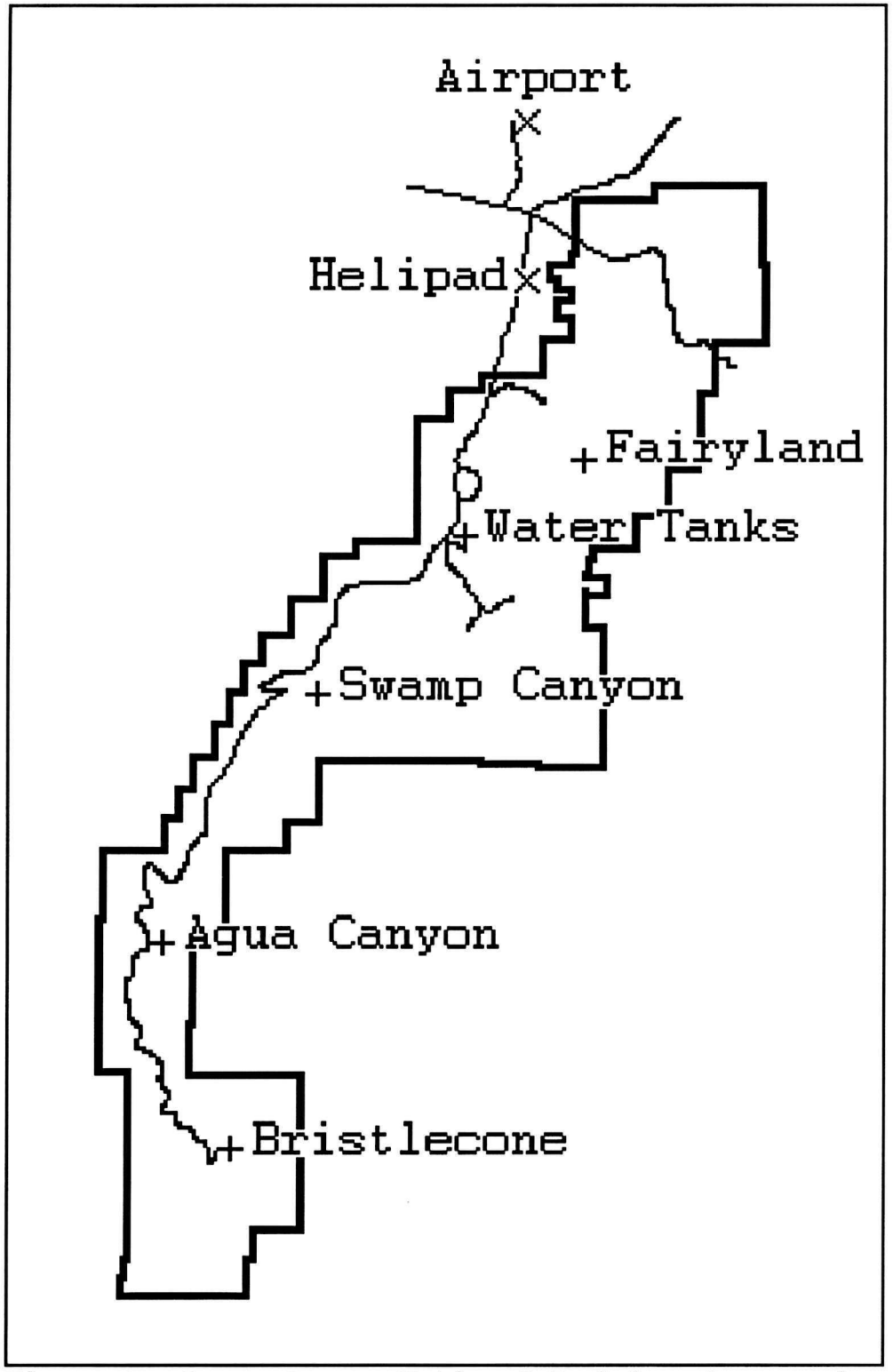

Figure 1. Bryce Canyon National Park boundary, noise monitoring sites, and aircraft landing locations.

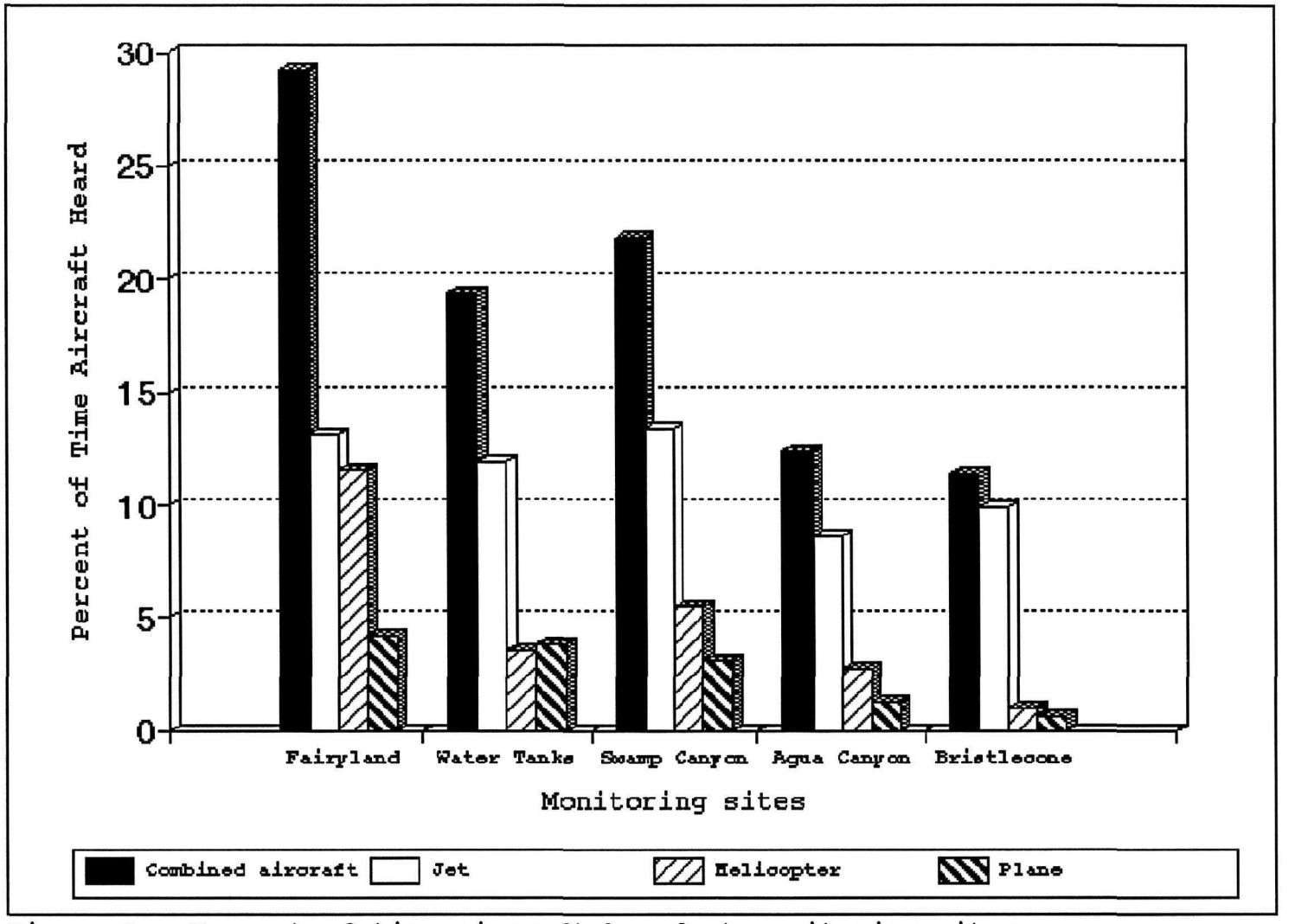

Figure 2. Percent of time aircraft heard at monitoring sites.

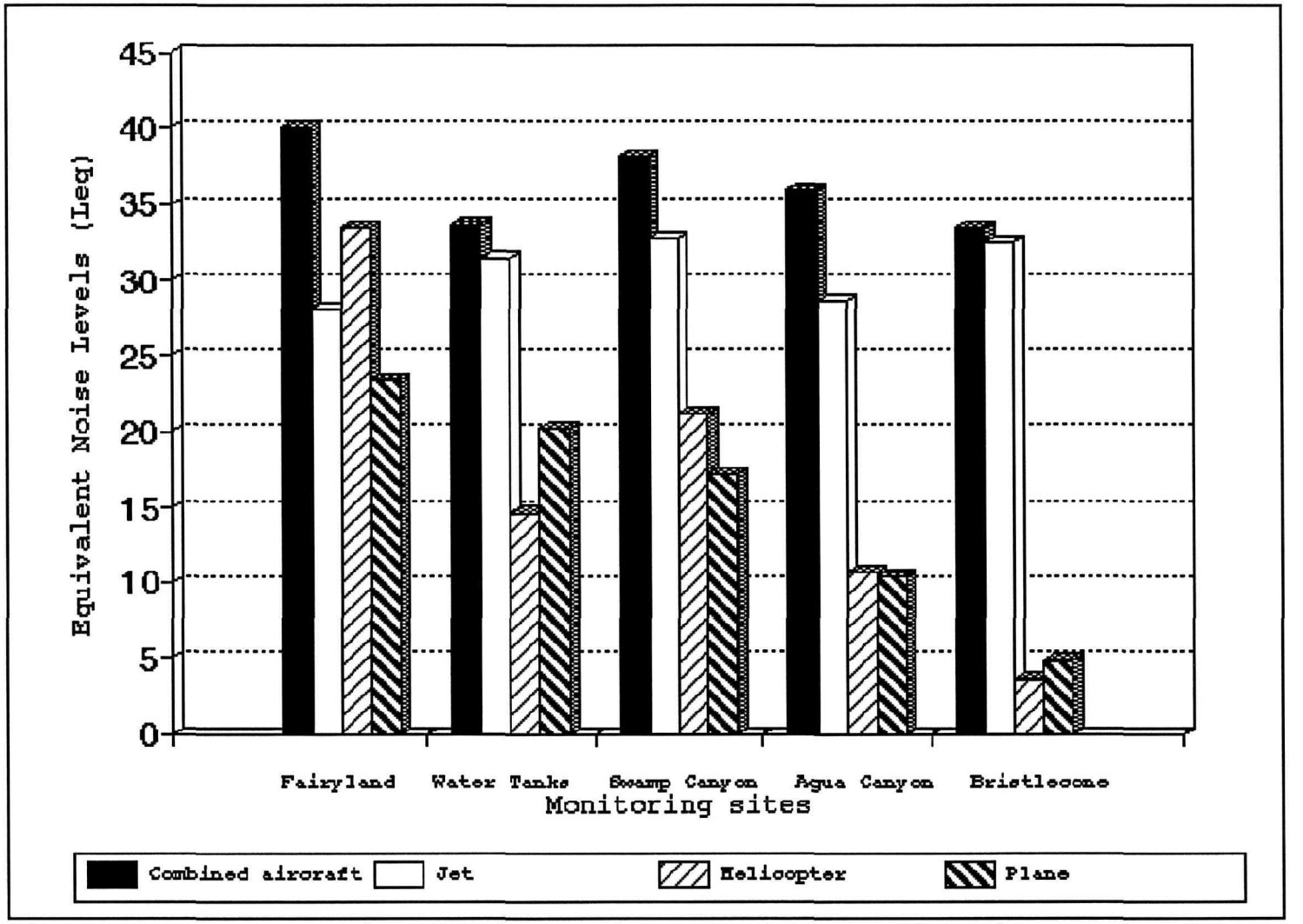

Figure 3. Average noise levels of aircraft at monitoring sites.