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Water Levels Effects on Overall Customer Satisfaction:

Crayton Pruitt
Clemson University, crayton03@yahoo.com

WATER LEVELS EFFECTS ON OVERALL CUSTOMER SATISFACTION: A CASE STUDY OF ADJACENT LANDOWNERS ON THE UNITED STATES ARMY CORPS OF ENGINEERS- LAKE HARTWELL

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Crayton Pruitt
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Dr. William Norman, Committee Chair
Dr. Bonnie Stevens
Dr. Greg Hawkins

ABSTRACT

The combination of hydroelectric power generation and the amount of precipitation results in fluctuating water levels on the United States Army Corps of Engineers: Lake Hartwell. Beginning in 2002 and continuing to the end of survey year 2004, water levels ranged from approximately ten feet below full pool to within half a foot under full pool. These fluctuations created difficulty for adjacent landowners to access sufficient water depths for recreational needs. The problems were magnified by a common perception that neighboring lakes', Lake Keowee and Lake Thurmond, water levels had not dropped as dramatically. This study examined the effects that lake water levels have on customer satisfaction of adjacent landowners on Lake Hartwell. The results of this study show that there is a link between satisfaction and water levels.

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INTRODUCTION

Located along the border of Georgia and South Carolina, Lake Hartwell (Figure 1) is a United States Army Corps of Engineers managed lake. The Flood Control Act of 17 May 1950 authorized the construction of the Hartwell Dam and Reservoir as the second unit in the comprehensive development of the Savannah River Basin. The estimated cost of this project was $68.4 million based at 1948 pricing levels and preliminary designs (USACE Annual Report, 1950). This vast lake created by the impounded waters at Hartwell has been used extensively for a number of activities which include hydropower, wildlife management and recreational activities such as camping, hunting, fishing, hiking, motor boating and sailing, etc.

The United States Army Corps of Engineers is responsible for water levels on Lake Hartwell and the fluctuation that is involved with hydroelectric power generation. The Corps of Engineers is a part of an electric cooperative, so there is a constant request for the generation of power. This function of power generation on the Hartwell Project, while vital to its mission serves as a major contributing factor in the changing water levels of Lake Hartwell.

The number of visitors to the project has increased regularly from about 750,000 in 1962 to over 10.5 million during 2006 (USACE-Fast Facts 2008). According to the Public Affairs Department of the United States Army Corps of Engineers- Savannah

District, Lake Hartwell has found itself atop the rankings list as the most popular Corps of Engineers project in the entire nation. Recently, it gained more national recognition when it hosted the 2008 Bass Masters Classic, a major professional bass fishing tournament which is covered by television throughout the world.

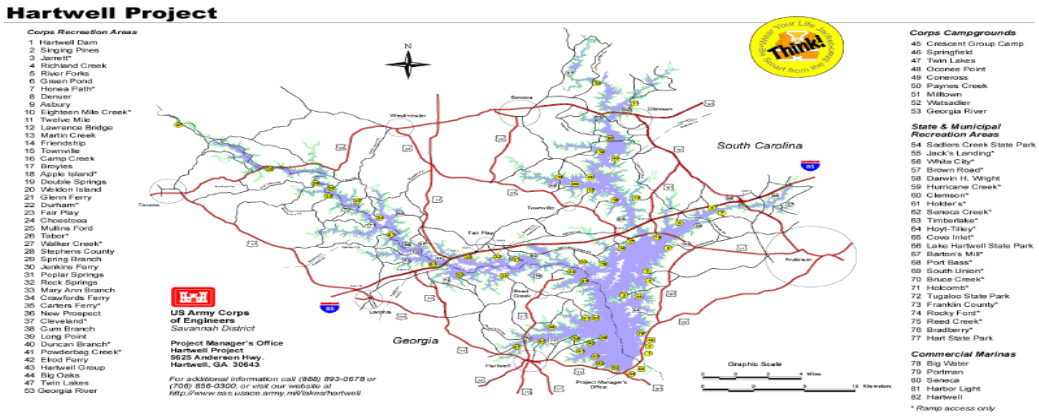

Figure 1. U.S. Army Corps of Engineers Provided Hartwell Project Map

Lake Hartwell is run in accordance to the Hartwell Shoreline Management Plan that was initially approved in 1979 after more than four years of work by United States Army Corps of Engineer personnel, four public meetings, and a congressional hearing (USACE Water Resource, 1981). This management plan for the orderly development of the lake's shoreline serves to protect and manage the shoreline, to establish and maintain acceptable fish and wildlife habitats, and to help meet the recreational needs of the adjacent landowners. Adjacent landowners are individuals who own property fringing the pre-established set backs from the high water mark surrounding the lake. The management plan became the subject of controversy shortly after its creation, because adjacent landowners were being required to improve their property to meet the standards

established by the Corps of Engineers. The plan sought to achieve a balance between the needs of these adjacent landowners while promoting a safe, healthful use of the shoreline for recreational purposes. However, many felt that if they were required to meet standards that the Corps of Engineers should also maintain certain minimum lake levels in helping to benefit these adjacent lands as well as the value and aesthetics of the bordering shoreline.

There are lake adjacent landowner associations, websites, and local newspapers that are avenues of communicating opinions with the Corps of Engineers and its management of Lake Hartwell. Organizations such as the Lake Hartwell Association which was founded in 1990, "...to protect the quality and quantity of water resources in Hartwell Lake and its watershed; to provide a forum for discussion and action on lake-related issues; and to influence positive growth and development while preserving the quality of life for all lake users" (LHA 2008). The Lake Hartwell Association acts on behalf of the adjacent landowners in working with the Corps of Engineers in continuing interactions and also helps to gain information and clarification for those that it represents.

THE PROBLEM

A major problem facing resource management agencies is their ability to gauge an overall general approval of the services provided such as recreational facilities, provided campgrounds, promoted fishing areas, hydroelectric power supplies, and water levels management. This problem extends to determining ways to increase effective communication of the agency's mission through public education or field interaction. The purpose of this study was to determine if links between water levels and satisfaction exist. In addition, the study attempted to determine ways to strengthen support as well as counteract negative opinions of these groups when relating to water levels and how they are maintained. Examples of perceived negative opinions in this study include: misleading media coverage, stereotypes from other situations, or rumor.

The United States Army Corps of Engineers on Lake Hartwell faces diverse public opinion concerning their role in the managing of Lake Hartwell. Common belief is that water levels are the largest issue when it comes to the overall opinion of what the adjacent landowners feel is an acceptable job managing this lake. This study was conducted to determine if there was a relationship between adjacent landowners' overall satisfaction with the corresponding water levels of Lake Hartwell that they own property on. For years the public has voiced their opinion of the management practices of area lakes especially the United States Army Corps of Engineers managing of Lake Hartwell. This study aimed at finding the relationships or trends that may be found over a set time

period to determine if the issue of water levels is a source of opinion that is voiced when it comes time for annual surveys, monthly meetings, and periodic news coverage.

SATISFACTION AND NATURAL RESOURCE MANAGEMENT

Satisfaction is a multi-faceted concept. It results from confirmation of expectations or positive disconfirmation (Pizam & Milman, 1993). If a person has a set idea about what they think a place should look like, how it should be run, what options should be available, and a consistency held; they will only find some form of dissatisfaction if those ideas are not met, closely abiding, or acceptably replaced with new and better ideas. Controversial land management actions are defined in this study as decisions that are made that affect a natural resource that is used by public and private entities and where these decisions may have a negative impact on these entities.

In this study the issue being examined is that of lake water levels and how the management of the water levels effects customer satisfaction. Certain expectations are held by each individual that owns property adjacent to this managed area as well as those who recreate on Lake Hartwell. This study focused on evaluating the surveys of adjacent landowners, with the goal of determining if there was a significant relationship between water levels on Lake Hartwell, as maintained by the Corps of Engineers, and overall satisfaction with this agency. Other land management agencies may benefit from this study and the results found and whether a relationship does in fact exist between water levels and customer's overall satisfaction. Connections with water levels have been researched previously one such study was that of the economic significance that was derived from fluctuation water levels. The study conducted by Grima (1993) found that

the fluctuating water levels of the Great Lakes for similar uses to that of this study have a clear impact upon the economic portion of the equation when looking at water levels and their resulting effects.

THE CIRCUMSTANCE

There are many reasons for water level fluctuations some of which are the release of water to generate power at Hartwell's hydroelectric dam (Figure 2), dry seasons or full drought (Figure 3), evaporation, and pumping of water for private usage. These combined make for regular changes in water levels, however these don't necessarily equal noticeable fluctuations due to the vast size of Lake Hartwell which consists of 56,000 acres of water and more than 962 miles of shoreline.

Figure 2. shows the variance in water levels from normal fluctuating water marks

Figure 3. shows adjacent landowners “Chasing Water” on Lake Hartwell during excessive drought

Satisfaction has been defined as ". . . an act of judgment, a comparison of what people have to what they think they deserve, expect, or may reasonably aspire to. If the discrepancy is small, the result is satisfaction; if it is large, there is dissatisfaction" (Campbell, 1980, p. 22). Satisfaction differs from both happiness, which is one's temporary affective feelings at the moment, and morale, which is the future-oriented optimism or pessimism in one's life (Mannell & Kleiber, 1997). Application of this study may help the United States Army Corps of Engineers determine the general feelings the public holds for the agency, what the public feels like they deserve from the agency, and what might be done to allow for clearer explanations as to why certain management decisions are made, also explaining what decisions are made that are amongst the agency’s control as opposed to natural causes that may affect the lake. The United States Army Corps of Engineers can design ways to improve interaction with customers while on-site, educate the public on their roles on Lake Hartwell, distinguish themselves from

both federal and state agencies, and to add these qualities to people's experiences to strengthen their support for the United States Army Corps of Engineers on Lake Hartwell.

This study utilized the ability to gauge the importance that land management agencies should place on transferring information to the public through all available avenues. The outcomes may assist land management agencies when deciding the most effective methods in sharing missions and goals of the organization, therefore, helping people to more thoroughly understand actions of the agency. These methods could increase public support outside of the normally gathered fees and accepted tax dollars.

Hull, Stewart and Yi (1992) examined properties of experience patterns of hikers during a short, stressful day hike. They focused primarily on changes in mood, satisfaction, and perception of scenic beauty and determined that hikers do differ from one another, yet cluster into distinct, homogeneous groups. The same can apply to the different factors that customers derive their satisfaction levels with Lake Hartwell these areas can also be grouped. For years, the United States Army Corps of Engineers in the Upstate of South Carolina battled rumors and political agendas that public figures and politicians created. Even in recent years a local political candidate Stan Jackson ran a slogan and based his platform for attempted election on "Abolish the Corps of Engineers." The candidate argued that the Corps controls, to a large degree, the level of the lakes, specifically in the Savannah District, which includes Lake Hartwell, Lake

Russell, and Lake Thurmond; and that the Corps management has become “absurdities”. (Pavey, R, 2002)

This study attempts to determine if the agency needs to find ways for the Corps of Engineers to explain the lake levels, along with other land management plans that often receive attention, such as game management and park/campground usage fees. Adjacent landowners were used in this study due to the interaction that they have with the Corps of Engineers directly and not just any federal agency that may be affected by such actions. The Lake Hartwell community is a dynamic area of new land development with turnover and an expanding population due to urban sprawl within the region.

THE METHODOLOGY

Determining the support people hold with the land management agencies in the Upstate of South Carolina has been limited. Segment surveys, small cursory surveys conducted by local management agencies that are generally conducted and used in house to evaluate its operations, have been used extensively by each federal land management agency in the area. This research examined the relationship between water levels and overall satisfaction over a three year period (2002-2004). Differences in water level over a three year period were compared by using an Analysis of Variance and a Scheffe Post-Hoc Test.

The data in this study was gathered from mail surveys administered by the United States Army Corps of Engineers, in which the questions were created by management with specific services and rating of these services. The surveys were mailed to each of adjacent landowners on Lake Hartwell and each year the returned surveys answers were tallied. The three years in this particular study 2002 (n=757), 2003 (n=785), 2004 (n=906) and the mean rating results are presented.

The specific research questions in this study were used to determine whether there is a relationship between water levels and customer satisfaction responses of shoreline owners.

1. Is there a significant difference in overall satisfaction levels from year to year (2002-2004)?
2. Is there a significant difference in average lake water levels from year to year (2002-2004)?
3. Is there a significant difference in lake water levels over a three year period (2002-2004) on neighboring lakes (Lake Keowee, Lake Thurmond)?
4. Does a significant difference in lake water levels in a previous five year period (1997-2001) preceding the survey years between the three lakes exist?

FINDINGS

The first research question was does a significant difference in overall satisfaction levels differ by year over the course of our survey years (2002-2004)? Table 1 indicated that the satisfaction ratings were increasingly higher as progression from 2002 to 2003 and 2004 survey years.

Table 1. Overall Satisfaction of Adjacent Landowners with the U.S. Army Corps of Engineers-Lake Hartwell (Scale 1=Very Poor to 5=Very Good)

YEAR	Number Surveyed	Mean Rating
2002	757	3.39
2003	785	3.88
2004	906	3.98
Total	2448	3.77

The results reveal that there was in fact a significant difference ($F= 79.612$, $p<.001$) between 2002, 2003, and 2004 on a scale of 1= very poor to 5= very good. Results of post-hoc test found that 2002 (mean= 3.39) satisfaction was significantly less than the following years 2003 (mean= 3.88) and 2004 (mean= 3.98). These variations in average ratings point to clearly a higher overall satisfaction rating in the latter two survey years.

The second research question was, is there a significant difference between lake water levels on Lake Hartwell in the survey years in this study of 2002, 2003, and 2004?

Table 2 shows that a large change in water levels occurred between the survey years from 2002 through 2004.

Table 2. Average Lake Water Level for U.S. Army Corps of Engineers-Lake Hartwell over a Three Year Survey Period (Full Pool= 660' MSL)

Year	Average Lake Water Level
2002	649.64'
2003	659.66'
2004	659.48'

The results from the analysis of variance determined that there was a significant difference ($F= 2663.447$, $p< .001$) between the survey years of 2002 versus that of 2003 and 2004. Results of the post-hoc test found that the average water level for 2002 (649.64') was significantly different from that of survey years 2003 (659.66') and 2004 (659.48').

The third research question was, do water levels of neighboring lakes (e.g., Lake Keowee and Lake Thurmond) significantly different over a three year research period (2002-2004)? These lakes use different footage marks to determine full pool, so in order to compare the lakes in this study the water levels were converted to a "percentage of full pool" to show actual amounts of water that were remaining in the lakes. Table **3** presents the yearly average lake water levels in each of the three survey years (2002-2004).

Table 3. Yearly Average Mean Pool Percentage to Full Pool

LAKE	2002	2003	2004
Hartwell	0.9843	0.9995	0.9992
Keowee	0.9464	0.9816	0.9815
Thurmond	0.9669	1.0003	0.9967

This study found that a significant difference (F= 5239.641) between Hartwell and that of Keowee and/or Thurmond in each of three years surveyed. The post-hoc analysis of the mean difference of the lake levels in Hartwell, Keowee, and Thurmond, for the years of ’02, ’03, ’04 showed that a significant difference was found between that of Hartwell against Keowee and Thurmond in the year of 2002. In 2002, Hartwell was significantly closer to full pool than that of Keowee or Thurmond. In 2003, Thurmond was significantly closer to full pool than that of Keowee or Hartwell; however, Hartwell was noticeably closer to full pool than Keowee. In 2004, Hartwell was significantly closer to full pool than that of Keowee or Thurmond; however, Thurmond was noticeably closer to full pool than Keowee.

The fourth research question, does a significant difference in lake water levels in a previous five year period (1997-2001) preceding the survey years between the three lakes exist? This question focused on the five year average, leading up to the chosen survey years, these years were 1997-2001. These five year averages for Hartwell, Keowee and Thurmond as shown in Table **4**.

Table 4. Five Year Average Mean Lake Hartwell Pool Levels (% to Full Pool)

Lake	Mean Pool %
Hartwell	0.9944
Keowee	0.9703
Thurmond	0.9884

The five year averages from 1997 through 2001 show that Hartwell (0.9944) remained noticeably closer to its full pool over the duration than that of Keowee (0.9703) or Thurmond (0.9884). This question was asked and analyzed due to common perception of stakeholders that the levels of these two other lakes were higher than that of Lake Hartwell. Years 1997-2001/ Five Year Average- Hartwell remained significantly closer to full pool than that of Lake Keowee or Lake Thurmond.

SUMMARY

The findings of this study revealed that overall customer satisfaction levels with the United States Army Corps of Engineers significantly differed ($F=79.612$, $p<.001$) between 2002 (mean=3.39), 2003 (mean=3.88), and 2004 (mean=3.98) on a scale of 1 to 5, where 1=very poor and 5=very good. These changes in satisfaction levels followed with a significant ($F=2663.447$, $p<.001$) increase in average pool water levels for the same time period (2002=649.64', 2003=659.66', 2004=659.48'). Findings indicate that increased adjacent landowners' overall customer satisfaction with the management of Lake Hartwell appears to be related to the corresponding rise in water levels. Additional analysis revealed that in 2002, Lake Hartwell (-10.36') endured a greater decrease in water levels than that of Lake Keowee (-5.36') but not quite as much of a decrease as that of Lake Thurmond (-10.93'). However, Lake Hartwell (98.43%) was closer to full pool than both Lake Keowee (94.64%) and Lake Thurmond (96.69%) during the same year based on size and the amounts of water that these lakes hold. These results have implications for the United States Army Corps of Engineers water level management policies and their relationship with adjacent landowners about water level management as a whole. Just as the other results of previous research questions, research question four's results showed that in fact Lake Hartwell over the period preceding the survey period of five years, that Lake Hartwell (0.9944) held closer to its full pool water levels over the duration than that of Lake Keowee (0.9703) or Lake Thurmond (0.9884).

LIMITATIONS

This study was constrained by several limitations. The use of secondary data hinders the ability to reexamine the numbers that were tallied for the survey years used. The date and water levels as well as determining what descriptives or coding of individuals were for each participant in the study can't be used, since the surveys were anonymously filled out by adjacent landowners and returned through the mail. This leads to a question of perception and how the geographic makeup of the area can make quite a difference, an example is the slope of the lake bed at the location of an adjacent landowners neighboring location, if it gently sloping the loss of one foot in overall water level could leave hundreds of feet of lake bottom exposed, whereas the same drop in water levels on a greater sloped area could almost go unnoticed to a common observer.

THE APPLICABILITY & IMPLICATIONS

This study found that a relationship exists between customer satisfaction levels and water levels that are maintained on Lake Hartwell. The research indicates that when water levels are down due to any reason whether be drought, need for hydroelectric power generation, maintenance of properties, or natural evaporation, that the customers feel as though their expectations are not being met and thus their satisfaction levels decline. This also shows that the opposite is true for when water levels are higher up and closer to the set full pool mark 660'MSL for Lake Hartwell, customer satisfaction levels follow the same trend and also are significantly higher. The results show us that the perception that Lake Hartwell was down more than the other compared lakes was false, not only during the survey years used in this study but also in the five years leading up to those survey years. The implications of this study can be used to improve support and understanding, specifically in this study, of the United States Army Corps of Engineers in the Lake Hartwell area.

Results can be compared with previous studies to determine differences. Likely, results will vary somewhat due to differences in location and the expectations of those surveyed from the land management agencies in this area. Future studies could examine other stakeholder groups such as recreational visitors, fishermen, campers, and sightseers; this differentiation could further the understanding of customer responses, experiences, and ideations. Future studies would greatly benefit at looking more in depth at the

perception part of the way geography plays into the satisfaction levels of the target groups. Use of geographical information systems (GIS) could help determine what an individual adjacent landowner can expect or sees when a specific water level is reached, this would also require coding of surveys to determine in a scientific way who the participant is and where they are located.

Managers should come to realize that they are not just managing the resource, but doing so in the best interest for their customers. Other future studies could elaborate and expand on an idea that Bonise (2003) developed, by further exploring the customers of specific agencies and the loyalty developed over time. Replication and expansion of this construct may be useful for other United States Army Corps of Engineers projects, other land management agencies outside of the defined area of this study, and possibly local economies that look to use water levels to gain tourism, permanent relocation of people to the area, or bring in outside businesses.

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