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***The Economic and Environmental Aspects of Colorado's Golf Industry***

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**Introduction**

Two recent studies of the US golf industry show that golf courses continue to grow as an industry, with 14,725 courses nationwide, compared to 13,258 courses in 1999. These facilities generate \$20.5 billion in direct revenues and \$62 billion in all associated economic activity (Golf 20/20 and World Golf Foundation). Yet, there is some concern with the decrease in golf rounds, which were down to 503.4 million rounds in 2002 from 518.4 in 2001. Meanwhile, the Mountain region (including Colorado, Wyoming, Utah and the northern halves of Arizona and New Mexico) also recorded a decline in rounds (19.7 million rounds in 2001 to 19.2 million rounds in 2002).

To assess the state of the industry in Colorado, compare its economic impact relative to the national industry and other Colorado sectors, and clearly define the role of golf in local economies, Colorado's golf industry decided to fund its own study. The Colorado Golf Association, Rocky Mountain Golf Course Superintendent's Association, Colorado Women's Golf Association, Colorado Chapter of the Club Manager's Association of America, Colorado Section PGA, and the Colorado Chapter of the Golf

Course Owner's Association collaborated with Colorado State University and THK Associates to complete the economic analysis presented here.

In addition to the economic impacts, golf also interfaces with the state's environment and impacts natural resource use in the state. Further complicating this issue, Colorado has been in the midst of a multiyear, chronic regional drought. The general public and lawmakers have raised environmental and economic questions as to the appropriateness of water utilization by green industries, including golf. The golf industry has also been criticized as being environmentally unfriendly. Yet, there is little research on the potential costs, if any, from a natural resource standpoint versus the economic benefits of the industry.

This paper will focus on a 2003 economic and environmental assessment of the golf industry in the state of Colorado. Using surveys sent to each golf course in the state, information on general characteristics of the course (location, number of holes, type of ownership), course revenue and operating expense questions, and environmental and resource use was collected.

This study attempts to, first, describe the economic size and scope of Colorado's golf industry and, secondly, to analyze the economic efficiency and environmental impacts of the industry's water, land, and resource use.

A direct survey of golfers was also developed that was used by teams who traveled to various courses across the state to survey golfers as to their preferences, experience, and spending patterns. These data were then compiled and used to assess economic value and resource use effectiveness from a consumer standpoint.

Golf courses have been criticized on four main environmental grounds: 1) they take away farm and natural lands, 2) they cause soil erosion and disrupt drainage patterns, 3) they inordinately consume water resources, and, 4) they pollute water resources with chemicals and fertilizers (Pearce 1993). This paper will focus on the first and the third criticism by comparing land and water use of golf courses to that of competing uses such as housing developments and agricultural use.

### **Materials and Methods**

The Colorado Golf Association, Rocky Mountain Golf Course Superintendent's Association, Colorado Women's Golf Association, Colorado Chapter of the Club Manager's Association of America, Colorado Section PGA, and the Colorado Chapter of the Golf Course Owner's Association sponsored a study by Colorado State University's Department of Agricultural and Resource Economics in 2003 on the Economic Impact of Colorado's Golf Course Industry. This project developed a comprehensive course-oriented survey on all aspects of golf course operations. The survey was sent out to all golf courses throughout the state of Colorado. The information was gathered and administered by Colorado State University (CSU) personnel.

A list of the superintendents, golf pros, general managers, and other relevant officials from each of Colorado's 264 golf courses was provided by the Colorado Golf Association and used to generate a mailing list. Completion of the survey required input from numerous individuals (course superintendent, general manager, pro shop manager and concessions personnel) at each golf course and the survey was organized to permit a cooperative effort among these professionals. A total of 610 surveys were mailed out to

the 264 courses statewide with surveys being sent to the owners, golf pros, superintendents and directors where applicable. An average of 2.3 surveys was mailed to each course.

The survey elicited 2002 financial information, water usage information from 2000-2002, rounds played information from 2000-2002, and capital project information for 2002-2003. A total of 99 courses returned at least one portion of the survey with 96 superintendent surveys and 70 financial surveys returned.

In addition to economic information, the survey requested information about perceived drought impacts, golf course water usage, wildlife habitat, and golf course turfgrass acreages. This information supports the economic study and provides the foundation for an analysis of the baseline resource use and environmental attributes of golf courses, as well as any changes made during the drought. Previously, there was not an accurate source for any of the information solicited in the survey, so this effort was intended to make golf's contributions to the economy and environmental impacts more transparent to the public.

### **Golf in the U.S.**

According to the nationwide Golf 20/20 initiative, as of January 1<sup>st</sup> 2003, there were a total of 14,725 golf courses in the United States, up from 13,528 courses at the start of 1999. The Mountain region of the US, which includes all of Colorado, Wyoming, Utah and the northern half of Arizona and New Mexico, had 466 golf facilities. Of these 466, Colorado had the largest share (250 golf facilities). The National Golf Foundation and National Golf Course Owner's Association estimated the number of golf rounds

played in the United States during 2002 to be 502.4 million, down from 518.1 in 2001 and 518.4 in 2002. The Mountain region of the US recorded 19.2 million rounds of golf in 2002, down from 19.7 million rounds in 2001. Still, the number of individuals who consider themselves golf participants has increased slightly over the past few years across the country. The number of golf participants in the United States in 2002 was 26.2 million, up 1.6% from 2001. On a per capita basis in 2002, there were 1.76 rounds of golf played per capita in the United States.

On average, there are 30,000 rounds of golf played on each course per year and courses average 150 acres in land usage in the United States. Thus, the total area of golf courses in the United States totals an estimated 1.6 million acres, an area slightly larger than half the state of Connecticut.

A recent study done by the World Golf Foundation found that the total value of golf to the national economy in 2000 was over \$62 billion. This figure includes the direct revenues that golf courses take in (\$20.5 billion) and the \$18 billion that accrue from affiliated “core” industries such as golfer suppliers, golf tournaments, and capital investment in golf. The \$62 billion also includes induced benefits such as tourism revenues (\$13.5 billion) and marginal value-added to proximate real estate prices (\$10 billion).

Other states have attempted to assess the economic contributions of their respective golf industries. Florida conducted a study in 2000 and found that the 1,334 golf courses in the state generated an estimated \$4.44 billion dollars in direct operational revenues. Florida’s golf industry employed a total of 73,000 persons and total operational expenses were estimated to be \$3.7 billion dollars.

In 2001, South Carolina found that the total economic value of the state's golf industry was \$1.5 billion in annual statewide contributions, with direct contributions from golf course revenues totaling \$989 million. Golf operations and allied industries also contributed 30,239 jobs and \$578 million in total payroll to the state's economy with an average \$19,114 in compensation for each new job created.

A 1997 study of the golf industry in Michigan found the total economic impact to be between \$950 million and \$1.7 billion from the 586 golf courses, depending on whether indirect and imputed economic activity was included.

### **Golf in the Colorado Economy**

According to the data collected in this study, there were an estimated 7,366,000 18-hole equivalent rounds of golf played in Colorado in 2002. This figure is down 5% from the 7,732,000 rounds played in 2000. On a per capita basis, there were 1.67 rounds of golf played per capita in Colorado during 2002. Over the past three years, the per capita rounds of golf played in the Colorado have been slightly lower than the national average (1.67 compared to 1.76 rounds per person).

The total acreage devoted to Colorado golf courses in 2002 was 35,600 acres. Of that total, 19,827 were in irrigated turfgrass in 2002.

Revenue for Colorado's golf industry totaled an estimated \$560 million in 2002. Greens fees accounted for 34% of the revenue and dues represented an additional 24% (figure 1). Total operational expenditures in 2002 totaled \$373 million. Labor represented 43% of the total operating expenses for golf courses in 2002 with capital

expenditures, operational equipment and supplies, and facilities maintenance representing 12%, 9%, and 8%, respectively (figure 1).

Golf in Colorado generated direct revenues of over \$15,700 per acre. By comparison, an optimistic yield for irrigated corn in Eastern Colorado is 200 bushels per acre and at \$2.00 a bushel this would generate \$400 dollars an acre.

On a broader scale, using World Golf Foundation multipliers, the total value of the golf industry to the state of Colorado is estimated to be over \$1.3 billion<sup>1</sup>. Generally, the multipliers are much smaller for capital-intensive, field crops.

All of the discussion on impacts due to specific types of golfers and expenditures in allied retail/industrial sectors signals that golf has a broader impact than the revenues spent at courses would suggest. Yet, estimating the broader impacts is somewhat complex.

At the national level, the World Golf Foundation's Golf 20/20 report expanded the economic reach of golf courses, augmenting direct revenues by the activity created by allied industries. For example, they give the industry credit for additional real estate economic activity (\$9.9 billion) equal to almost 50% of the direct revenue total (\$20.5 billion). If we did the same for Colorado, that would add another \$270.5 million in economic activity for real estate. Still, this added value/economic activity is far less than the \$882 million calculated earlier. Using the same logic, Colorado's golf industry also supports \$368 million in hospitality and tourism, \$123 million in media and tournaments, \$163 million in golfer supplies and \$213 million in capital expenditures (which is higher than the numbers reported directly by courses in our survey by a magnitude of four, but

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<sup>1</sup> The World Golf Foundation found a total economic multiplier of three when both indirect and induced effects are included.



may represent capital investments by associated economic sectors (golf stores, hotels, nearby restaurants)).

As a comparison to the Golf 20/20 approach, we developed a more directed economic impact analysis for Colorado using primary data and a customized IMPLAN economic analysis. IMPLAN is based on specific economic relationships. The categorization of economic activity by IMPLAN can be summarized in these three areas:

- Direct effect refers to production change associated with a change in demand for the good itself. It is the initial impact to the economy, which is exogenous to the model.
- Indirect effect refers to the secondary impact caused by changing input needs of directly affected industries (e.g., additional input purchases to produce additional output).
- Induced effect is caused by changes in household spending due to the additional employment generated by direct and indirect effects.

When a business expands or contracts, there is a ripple effect through the economy. For example, when a golf course expands, they buy more mowers and fertilizer and they hire more workers. This new economic activity generates even more activity in related businesses who sell to the course, and who, in turn, buy more inputs and hire more labor. The total impact of a change by one industry therefore is multiplied through the economy through various linkages to other businesses and payments to workers. To capture this effect, it is necessary to use an economic model that contains these linkages, but it is virtually impossible to fully determine linkages through an entire economy by means of surveys and individual projects. Still, this study goes further than most

economic analyses in directly collecting a large share of primary data to integrate into IMPLAN.

Of every dollar of golf course output, a certain amount is paid to providers of inputs from other sectors. Every dollar of golf course output can be broken into input cost and value above the costs of the inputs, which is value-added. In the golf course industry, a total of 47% of each dollar is accounted for as inputs from other sectors. The remaining 53% is value added, which goes to employee compensation, proprietary income, and other incomes not accounted for in the cost of the inputs.

The economic outcomes of an IMPLAN simulation are based on two important features in the model, multipliers and regional purchase coefficients (RPCs). The multipliers describe the size of the indirect and induced effects that expansion in a certain industry yields through its contribution to other input sectors. The largest suppliers of golf course inputs are the building materials and gardening sector, which accounts for course operational equipment and some capital expenditures, followed by the retail sector, building construction, food and beverage, and maintenance sectors. The dominance of local sourcing among these sectors is part of the reason there is a relatively high multiplier for this industry.

The sizes of the indirect and induced multipliers are also affected by the economic activity that spills out of the study area, the state of Colorado. The leakages from the study area come from purchases that are made for imports, which do not multiply through the local economy as fully as purchases from businesses inside the study area.

Specifically, IMPLAN draws on the Regional

Purchase Coefficient for an industry, which indicates the proportion of purchases made by an industry locally. For the golf industry, the RPC for its top 15 input sectors is 0.86, suggesting that 86% of the purchases for golf courses are made locally. Meanwhile, the same RPC for all sectors is 0.46, a significantly lower number. In short, the golf industry will have a higher economic impact multiplier because of its value-added and the “local” nature of many of its input purchases.

Together, all of these parameters influence the multiplier effect an industry has on the economy. By definition, the direct multiplier for any industry is 1. The indirect and induced contributions from the subsequent economic transactions with other local businesses (as explained above) are then added on top of that effect. Overall, we found that the total impact on the economy from the golf sector is indexed by a multiplier of 2.13, so that an additional \$1.13 in sales is generated from an expansion of the golf course industry by \$1 (or lost in the case of contraction). Using this multiplier, we can assume that the broader economic impact from golf on the Colorado economy is \$1.2 billion. There is a similar multiplier developed for employment, an important factor for economic development and policymakers focused on job creation.

### **Land and Water Resources**

In general, the golf industry and turf and landscape management have received a great deal of negative press over the past decade for their resource use and negative environmental impacts. The perception is that golf courses take up a great deal of land and habitat, pollute with turf chemicals, and use an inordinate amount of water, a particular concern in the western United States (Stix 1994).

For example, it has been proposed that the amount of water used on the average golf course is enough to support the daily needs of 2,000 people and this number rises to 11,000 people in arid courses in California (Selcraig 1993).

According to the Golf Course Superintendents Association of America golf courses in the United States use an average of 300,000 gallons of water per day. But, this number varies by region, with courses in Texas using under 197,000 gallons per course per day, on average, and courses in Florida using over 375,000 gallons per course per day (Hawes 1997).

Florida's roughly 1000 golf courses used a total of 173 billion gallons of water in 2000, almost half of which came from recycled water sources. Water use per acre in 2000 totaled 844,000 gallons.

Turning to residential lawns, over half of the 150 million gallons of water the average residential consumer uses is consumed in the form of landscape irrigation. In the arid west, turfgrass watering accounts for over 60% of urban water use (Fisher 2003). Healthy bluegrass needs about 18 gallons of water per square foot per year.

The U.S. EPA has attempted to determine the total national lawn acreage data from the 1990 U.S. Census, Federal Housing Administration figures and the various available state surveys. They calculate the total U.S. home-lawn acreage to be between 14 and 26 million acres, with a conservative estimate of 17.7 million acres.

The EPA then divided this by the number of single-family housing units with lawns (62.9 million, according to the 1990 U.S. Census) and obtained an average of 0.28 acres, or around 12,200 square feet, of lawn per home.

However, Lisky (1997) cautions against applying these averages to specific situations. Clear regional differences are apparent in the figures. For example, four arid-climate states-Arizona, California, Nevada and New Mexico-averaged 0.12 acre (about 5,200 square feet) per home lawn, whereas the Northeastern states of Maine, New Hampshire and Vermont averaged 0.46 acre (about 20,000 square feet) per lawn.

Having cautioned against extrapolating using national averages, this paper still concedes that they are the best available numbers for the purpose of comparing the relative water use between lawns and golf. Using national averages, lawns in the United States use 21,600 gallons of water per year per lawn. This translates into roughly 652,000 gallons of water per year per acre of lawn.

Based on an average golf course size of 160 acres and an average water use of 300,000 gallons per course per day, golf courses in the United States use 684,000 gallons of water per acre per year. This is 5% higher than the national average of water used per acre on residential lawns.

Colorado, along with much of the Western region, experienced a drought in 2002. Courses adopted a variety of strategies to reduce water usage in 2002 in response to the drought. Nearly every course surveyed in this study employed at least one water conservation technique in 2002 (figure 5). According to survey responses, the most popular water reduction strategy was the use of wetting agents with 85% of the courses employing them. The elimination of irrigation in selected areas (76%), reducing rough irrigation (74%), hand watering tees (70%), and adjusting fertilization practices (71%) were also popular water conservation techniques. The resulting total water use for

Colorado's golf courses in 2002 was 15.6 billion gallons, down slightly from 15.8 billion gallons in 2001, but up from 15.4 billion in 2000.

Water use did decline in 2002 in response to the drought conditions, although usage only dropped by 1.5% (figure 3). This number, however, may be misleading due to the increased water use requirements caused by the 2002 drought. It was calculated that a typical Front Range golf course would have needed to increase their irrigation by about 25% in 2002 to offset the effects of the high temperatures and low precipitation. This coupled with the actual overall reduction in water consumption means that real net water savings in Colorado in 2002 is closer to 25%.

When asked in a separate question "what was the course's percentage actual reduction in irrigation during drought in 2002", the average response was a 19% reduction. So, the courses obviously perceive that they made a substantial reduction in their total irrigation usage and this figure is probably accurate increased water when adjusted for the increased evapotranspiration rate in 2002.

The courses also managed to shift some of their irrigation water from surface water to reclaimed wastewater. The use of reclaimed water has risen significantly from 2000 to 2002 (figures 7 and 8). In 2000, 61% of the irrigation water came from surface water while 10% was from reclaimed water. In 2001 the percentage of surface water declined to 59% and reclaimed water use increased to 16%. By 2002, surface water use had declined to 52% and reclaimed wastewater had increased to 20% (figures 7 and 8).

Water use on golf courses was found to be 437,000 gallons per acre per year. On a per square foot basis, this works out to 10 gallons per square foot. When looking at just maintained acres, golf courses in Colorado use 15 gallons per square foot.

By comparison, healthy bluegrass lawns require about 18 gallons per square foot per year. According to GreenCO, an association of Colorado's green industries, the average size of a lawn on Colorado's Front Range is around 5,000 square feet. On average, golf courses in Colorado occupy about 80 acres of irrigated turfgrass, which is about 3,484,800 square feet. This translates into about 700 average size lawns. If looking at total golf acreage, the average golf course occupies about 150 acres, which translates into 6,534,000 square feet. This represents about 1,300 average sized lawns. Well maintained lawns are appraised at 7% of a homes value. In terms of a cash flow for an average Front Range home, this translates into a value of a lawn to a homeowner of about \$6000 per year. On average each course in Colorado generates 31,000 rounds of golf per year. Based on survey data, an average round of golf generated \$42 per round in just greens fees and/or dues. This translates into \$8650 in direct revenue per acre per year from golf course fees and dues. 15299

As a comparison, irrigated corn in Colorado uses approximately two acre-feet per acre a year to generate maximum yields. This is equivalent to 650,000 gallons of water per acre per year, almost 50% more water per acre than is used on golf courses.

Land use issues are also of concern when dealing with the resource impacts of golf courses in Colorado. In 2002, Colorado's golf courses covered 35,600 acres. Of these, 22,300 were maintained golf related acres and 19,800 acres were in irrigated turfgrass (figure 6). The difference between these numbers represents unirrigated roughs and landscaped areas of the clubhouse grounds. The remaining 13,300 acres were in unmaintained and natural areas. Of the unmaintained acres, 34% were in grasslands,

14% were in ponds, 10% in forests, and 7% in wetlands. The remaining acres were classified as other unmaintained areas.

### **Wildlife Implications**

Habitat loss due to golf courses has also been a criticism levied against golf course development. According to the Maiistakis Institute for the Rockies' report on Golf Courses and Wildlife, golf course development has few long-term benefits to wildlife. The report, however, admits that in comparison to other development options, such as housing or commercial development, golf courses may be less destructive to wildlife.

The Audubon Society initiated the Audubon Cooperative Sanctuary Program (ACSP) in 1991. This program provides guidelines and principles for golf course environmental management, habitat protection and enhancement, chemical use reduction, water conservation, and water quality management. Currently, over 2,300 golf courses are members of the ASCSP and the Audubon Society has the goal of registering 50% of all golf courses in the United States by 2007.

Golf courses employing ACSP principles and adhering to the guidelines of the program represent a powerful opportunity for golf courses to improve their environmental stewardship and public perceptions of golf's relationship to the local ecology.



In Colorado, 47% of all golf courses claim to participate in the Audubon Cooperative Sanctuary Program, but only 15% are actually registered with members of the program. An average of 2.56% of each golf course in Colorado can be considered wildlife habitat. This works out to a total of 911 acres of wildlife habitat. This number, however, may not include all habitat types and may be biased towards only large animal habitat. The total acreage of unmaintained and natural lands on Colorado's golf courses is closer to 12,000 acres, much of which can be considered habitat for migratory birds and small mammals.

But, traditional agricultural producers appear to be better environmental stewards. By comparison, as of the beginning of 2000, the Colorado Division of Wildlife has designated 88,000 acres of agricultural lands as wildlife conservation easements. Part of the difference may be incentives given to agricultural producers through Farm Bill programs, such as CRP. According to the 1997 Federal Census of Agriculture, the total land in Colorado farms totaled 31.6 million acres, averaging 1,090 acres per farm. This breaks down to less than .005 acres per farm designated as wildlife habitat.

### **Conclusions:**

The economic role of the golf course industry in the U.S. and in Colorado is quite sizable, but like many industries, requires an investment of limited and precious natural resources. This paper has provided a brief overview of economic impacts, together with a description of water resource use and a comparison of how both economics and resource usage compare to more traditional agricultural and landscape enterprises.

Overall, golf produces more revenues per acre of land or acre-foot of water than corn, but value-added may be a better measure of resource use efficiency and effectiveness. Still, many of the expenditures that lower revenues to value-added are also important elements of a local economy (such as the 43% of golf costs that go to labor expenditures), so more integrated, IMPLAN, analysis of these issues is warranted.

Possibly the most positive message from the initial analysis of these golf surveys is the water usage “net conservation”, increase in use of “recycled water” and increased environmental activism among golf courses. Even if it takes the “shock” of an unfortunate event like the current drought, heightened awareness and attention to environmental stewardship will likely serve the golf industry well in terms of public relations and economic sustainability.

## **References**

Fischer, Adelheid 1993. "Grass is not always greener: reasons not to love lawns." Utne Reader. Sep/Oct 1993. 36-8.

Hawes, Kay 1997. Quenching Golf's Thirst. Golf Course Management. June 1997

Lisky, Eric. 1997. "Research Update." Grounds Maintenance. March 1, 1997.

Pearce, Fred. 1993. "How Green is your Golf?: Environmental Effects of Golf Courses," New Scientist, September 25.

Selcraig, Bruce. "Greens fees." Sierra Vol.. 78 (Jul/Aug 1993). 70-7+.

Stix, Gary. 1994. "Antigreen greenies; activists flag opposition to the royal and ancient game." Scientific American: Vol. 271 (Aug 1994). 86-7.

Figure 1

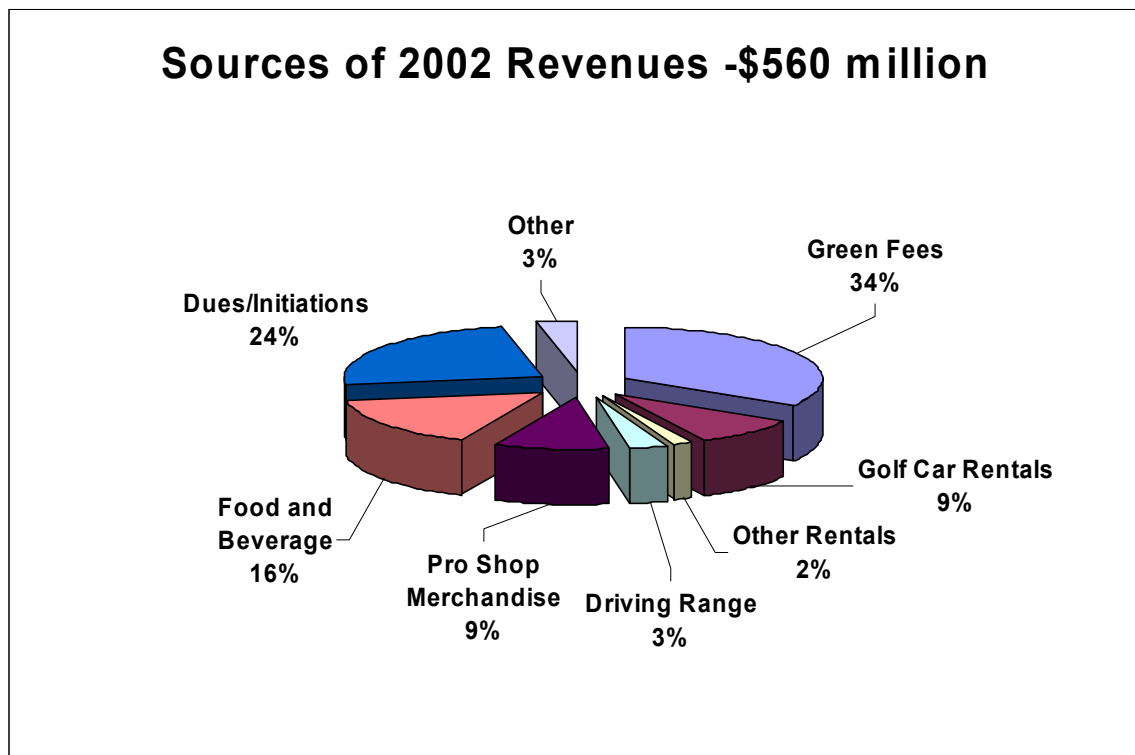


Figure 2

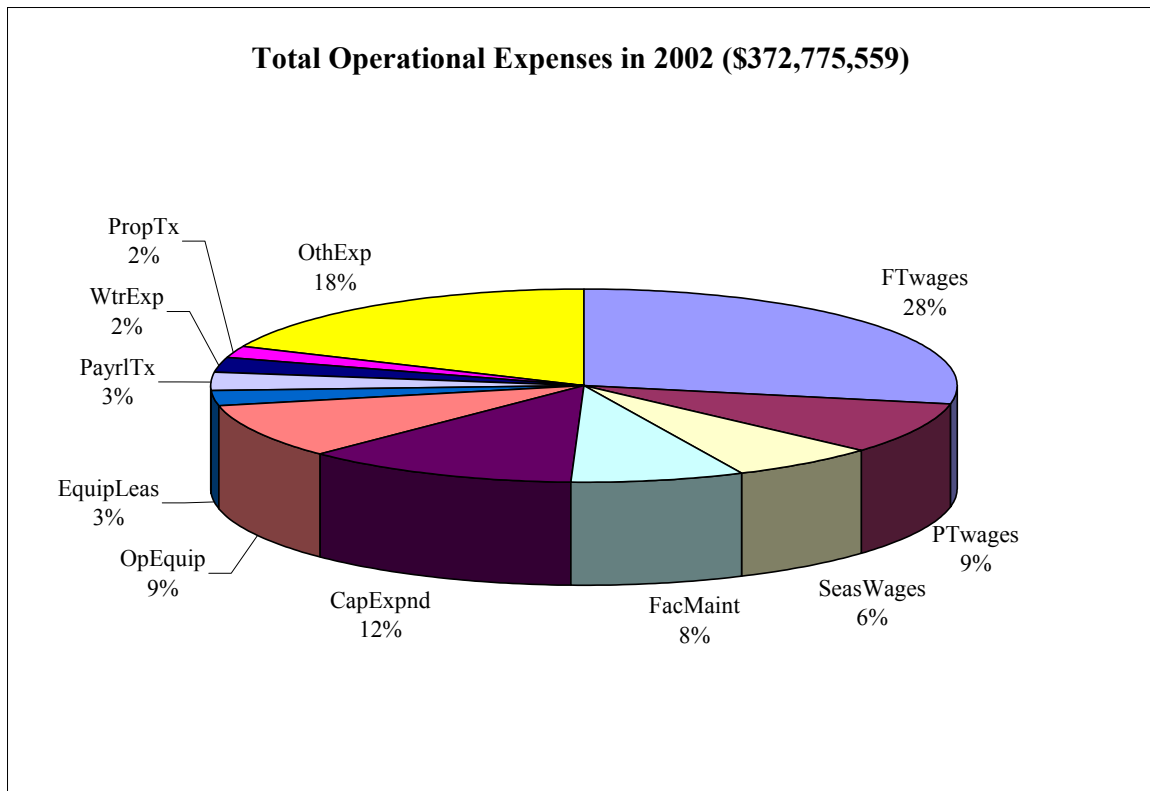


Figure 3

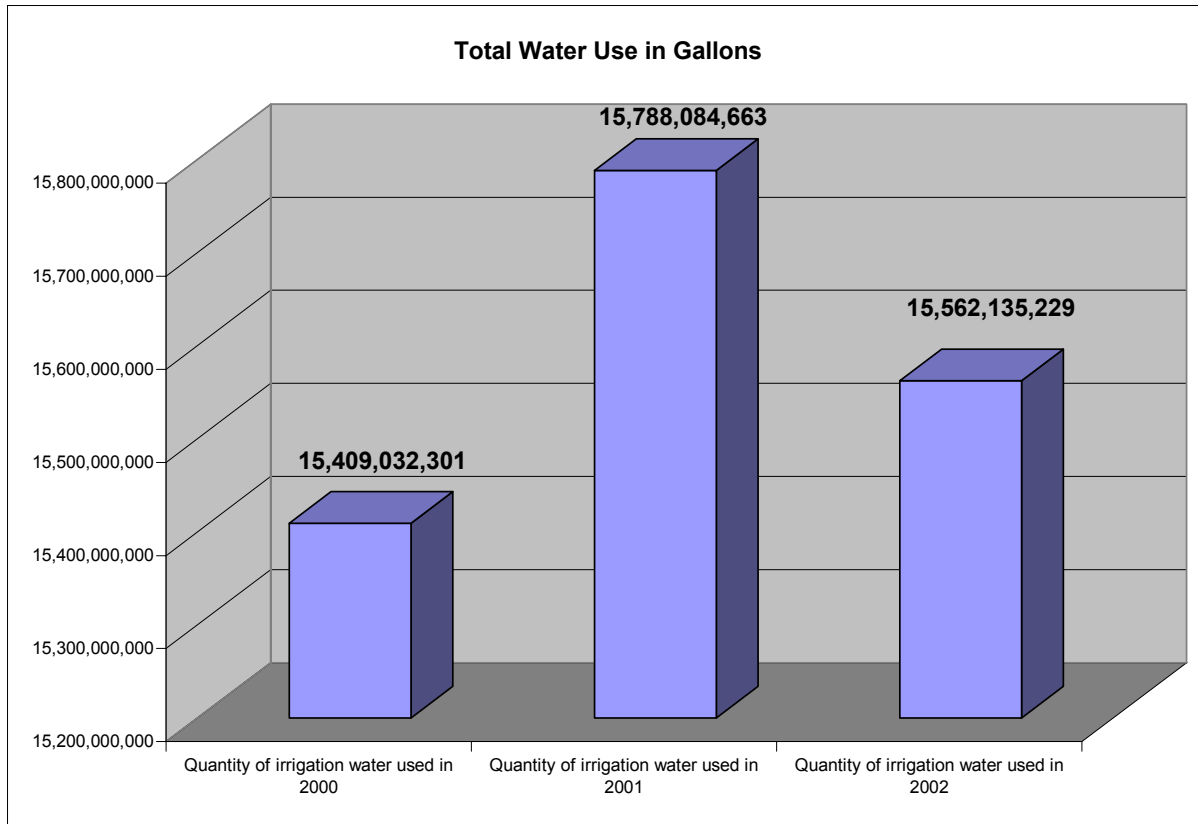


Figure 4

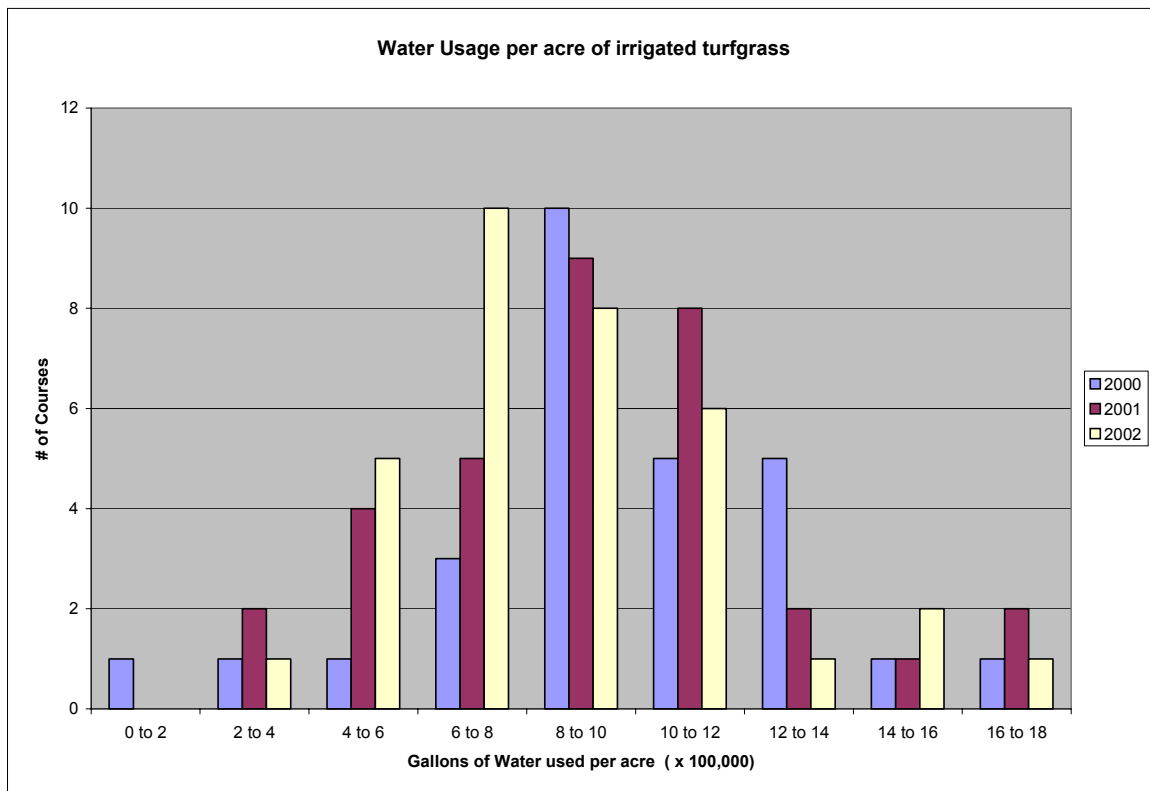


Figure 5

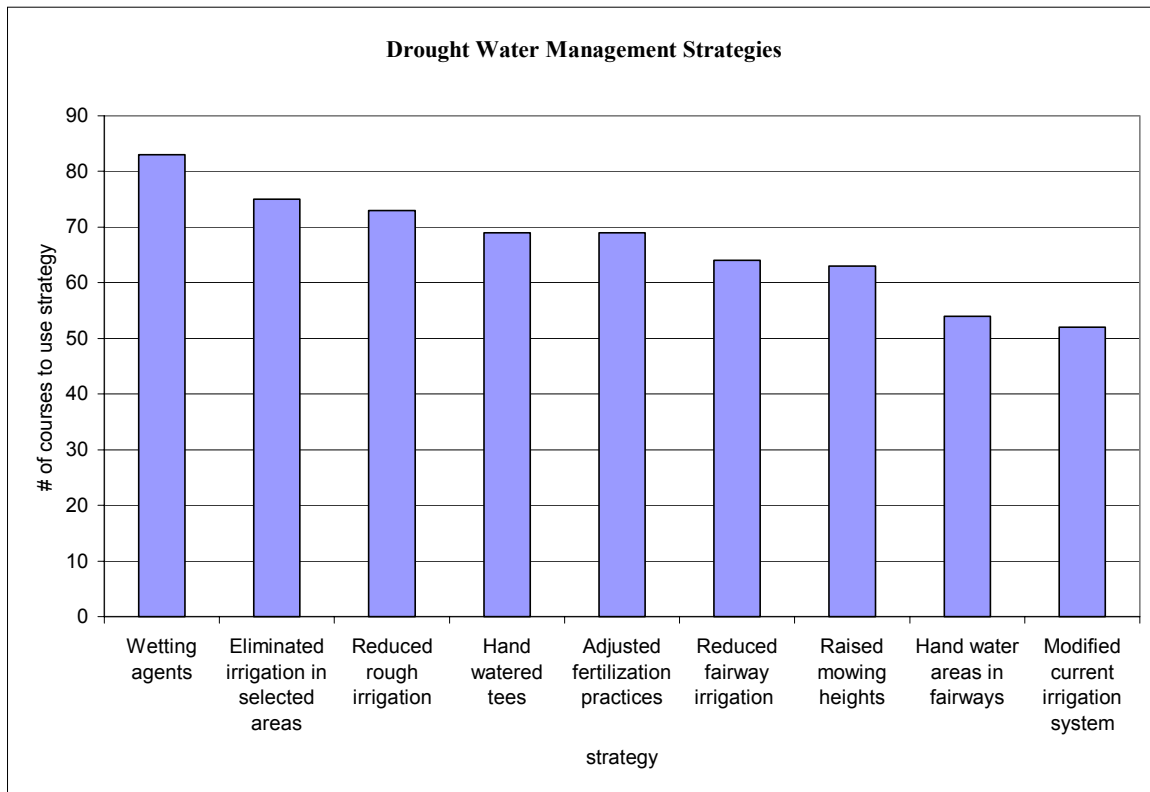




Figure 6

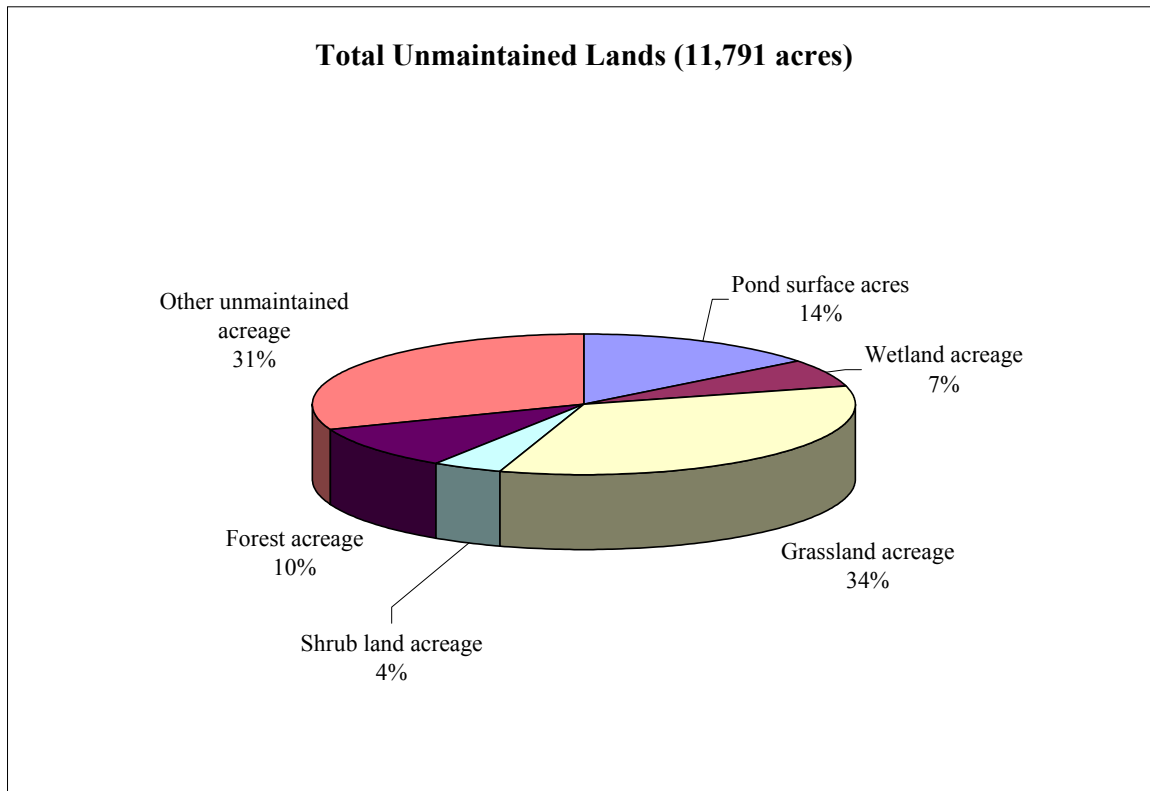


Figure 7

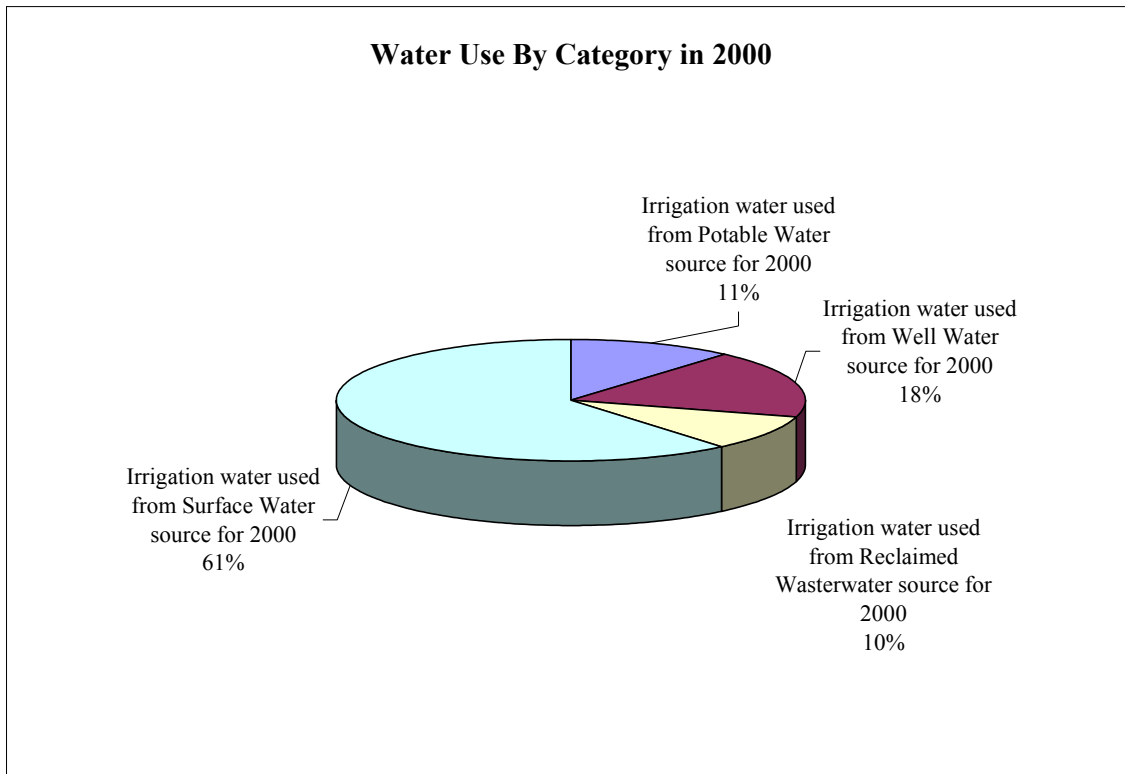


Figure 8

