Draft

Agriculture Drainwater: A Resource for Sustaining Avian Biodiversity?[1]

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INTRODUCTION

The year 2000 Global Environment Outlook Report issued by the United Nations stated that "full-scale emergencies" exist as a result of water shortages. Over the next 25 years the world will begin to run out of freshwater and "water wars" could spread across a wide belt of North Africa, the Middle East and Asia. Battle lines over water have already been drawn in southern California for a conflict of great significance for the long-term conservation of North American avian biodiversity and the economic health of the Imperial Valley. The "armies of liberation" seeking additional water resources are components of the large metropolitan areas of southern California. The "forces of opposition" are local interests. Those forces are being strengthened by "expeditionary forces" from the natural resources conservation community.

[1] Healthy Ecosystems, Healthy People Symposium, Washington, D.C., June 6-11, 2002.

The battleground involves familiar terrain - conflict between water needs for agriculture, urban development, and wildlife stewardship. At risk are the continued viability of the Salton Sea as habitat for the nearly unprecedented avian biodiversity that utilizes this waterbody and its sustainability as one of the most productive inland fisheries in the world. A unique aspect of this conflict is that agriculture drainwater sustains the richness of avian biodiversity and the productivity of the fishery of the Salton Sea.

A current Val Kilmer movie titled, The Salton Sea, portrays the dark side of human life. Similarly, real world images often used by those opposed to sustaining the Sea, and media presentations by those with only superficial understanding of this ecosystem, typically portray this environment as the dark side of ecosystem health. Typically, the images portrayed are that of an "environmental slum" to be avoided because of health risks for those foolish enough to enter this area. In addition, until recently, many within the natural resources conservation community were at best ambivalent towards the Salton Sea. Some took positions that this environment was unworthy for concern or salvation because it was considered to be human created rather than a natural environment. Greater appreciation of the avian biodiversity values present has now shifted those viewpoints towards a position of "saving the Salton Sea." This presentation uses the Salton Sea as a contemporary example of the expanding conflicts over water and how collaboration between agriculture and wildlife interests can benefit both through pursuit of the session theme, "Managing Agriculture Systems for Biodiversity and Ecosystem Health."

I will begin with a historical perspective of environmental changes that have taken place within this ecosystem relative to the development of agriculture, the Salton Sea, and their associated human and biological transitions. The presentation will be completed by highlighting the current issues and needs associated with the ecosystem health of this environment and by providing a perspective for a joint venture to provide for the long-term sustainability of local agriculture, regional economic well-being, and biological diversity of international importance.

HISTORICAL PERSPECTIVE

. A brief historical review is useful to place both agriculture and the Salton Sea in context relative to their linkages that exist with biodiversity and ecosystem health. The Salton Sea is California's largest inland waterbody. It lies at the center of the Colorado Desert, approximately 40 miles north of the border with Mexico. This closed basin waterbody of approximately 35 miles in length and 15 miles at its widest point is essentially sustained by drainwater from the agriculture fields of the Imperial and Coachella Valleys. It is located within a geographic area referred to as the Salton Trough, a below sealevel depression that is part of the historic Colorado River Delta. The surface elevation of the Sea is –227 feet below sea level. Ambient summer temperatures commonly reach 115 to 120 F.

The Salton Trough became an inland area thousands of years ago following the formation of a natural levee by Colorado River sediments that reduced the reaches of the Sea of

Cortez. Thereafter, portions of the Salton Trough were subjected to periodic flooding by the meandering Colorado River. Depending on the magnitude of initial flood events and the periodicity of subsequent flooding, freshwater lakes of varying size were formed that persisted from a decade to hundreds of years. The last historic Lake Cahuilla took approximately two decades to fill, was 26 times the size of the current Salton Sea, at its peak had an elevation about 40 feet above sealevel and evaporated to dryness during the 1600s.

The cyclical historic pattern of waterbodies and dry desert were boom and bust situations for whatever fish and other wildlife populations were present. There was also a transitional habitat gradient for sustaining those populations due to the increasing salinity of the waterbodies as they evaporated to dryness. The evaporation rate of approximately 5.6 feet per year overwhelms the average annual precipitation of 2.5 inches, rapidly removes surface waters and concentrates the natural low level of salt present in the Colorado River input water. As evaporation occurs the salinity of the remaining waters increases in the absence of additional freshwater inputs. The volume of water lost through evaporation results in dry lakebeds of the area having extensive salt flats.

Anthropogenic Changes

Human habitation within the Salton Trough during historic times was essentially limited to nomadic desert Indian tribes. Significant human modification of this area began with entrepreneur development of irrigation canals that in 1901 brought Colorado River water

into the Imperial Valley to support the development of agriculture. The resulting landscape change was rapid and established permanent human settlement where it did not previously exist. Desert sands were transformed into one of the world's most productive agricultural areas and settlement by non-native peoples rose from close to zero in 1900 to more than 10,000 by 1904. That year more than 120,000 acres of desert were under cultivation, another 200,000 acres were covered by water stock, and what had been the landscape and habitation for the area now labeled as the Imperial Valley had been forever changed.

Formation of the Salton Sea

The creation of the Salton Sea has its origin in 1905. Unprecedented flooding by the Colorado and Gila Rivers resulted in the breach of an irrigation control structure and an 18-month pouring of the runaway Colorado River into the Salton Trough. By the time the breach was closed in 1907 a lake with a maximum depth of 83 feet above the desert floor had been formed. This waterbody was subject to the same historic pattern of water loss from evaporation and increasing salinity that occurred for previous waterbodies. By 1925, the predicted date for evaporation to a salt flat, the Salton Sea had been reduced to a maximum depth of 28 feet. The reason it had not become a salt flat was that agriculture drainwater was replenishing some of the water lost to evaporation. That condition had not previously existed and added a new dimension to the dynamics of this ecosystem.

Inflows to the Salton Sea continued to rise after 1925 as agricultural success continued to put more acres under cultivation. An equilibrium was reached at the current elevation level of –227 feet below sea level and has been maintained. The annual inflow is approximately 1.35 million-acre feet and a similar amount of surface water evaporates. Also, the 1935 closing of Hoover Dam and the development of other dams along the Colorado River forever ended the historic periodic flooding of the Salton Trough by the River. The new dynamic for this area became the Salton Sea as a large permanent waterbody within this desert environment.

Society and the Salton Sea

Having a large desert oasis within relatively close proximity to the large metropolitan areas of San Diego and Los Angeles is what dreams are made of if you are a land developer. Development of the Sea as California's Riviera focused on recreational opportunities, vacation homes, and the Salton Sea as a retirement "heaven." Post-World War II development persisted for about a quarter-century, aided by some of the Hollywood jet-set using the Sea as a playground. The Salton Sea State Recreation Area was created in 1955, stretches approximately 18 miles along the northeastern portion of the Sea, and provides 1400 campsites for visitors. Visitor use peaked at over 600,000 during 1961-62 and was for that time greater than Yosemite National Park.

As agriculture continued to put more drainwater into the Sea its elevation rose because of the flat topography of the desert basin. The result was inundation of shoreline

developments and recreational facilities. In addition, increasing salinity, a selenium health advisory relative to the amount of fish from the Sea that should be consumed, major fish die-offs, financial difficulties of a major Salton Sea land developer and other factors resulted in the positive images of the Sea being seriously tarnished by the mid-1970s. A general and continual collapse of the Sea as a recreation and vacation mecca followed. Sport fishing, bird watching, waterfowl hunting, and camping have persisted at the Salton Sea but at greatly reduced levels.

Biological Transitions

The Colorado River has been the origin of all of the waterbodies within the Salton Trough. Therefore, the initial fish and invertebrate biota have been those species present in the water being deposited by that freshwater river. Those species then died-out as the rising salinity exceeded species tolerances. Having a fishless waterbody is not consistent with a recreation focus for the Salton Sea. Therefore, efforts to introduce saltwater and salt-tolerant fish were undertaken. Three species, the gulf croaker, sargo and the orangemouth corvina became established and quickly resulted in the Salton Sea becoming acclaimed for its sport fishing. The establishment later of tilapia resulted in the Sea becoming one of the most productive inland fisheries in the world. Anglers during the past month have commonly taken limits of corvina with individual fish weighing between 10 to 20 pounds. Corvina in excess of 30 pounds have been caught as recently as last year.

The waters used to transport introduced fish contained many microscopic life forms, algae and other "little critters" that were inadvertently also introduced into the Salton Sea. A detailed study of the limnology of the Salton Sea published in 1961 documented about 70 species within the waters of the Sea. A recent study conducted as part of the scientific evaluations associated with the Salton Sea Restoration Project has disclosed approximately 400 species, a substantial number of which are new to science. These differences reflect how dynamic this young ecosystem is.

External factors, such as drainage that has claimed 95 percent of the interior wetland acreage of California, drainage elsewhere within the Pacific flyway and other landscape changes have resulted in the Salton Sea becoming an unplanned "mitigation" wetland. The food base afforded by the fish, invertebrate and plankton communities of the Sea, and that of the surrounding agricultural fields, provides a haven for birds. More than 400 species of birds have been recorded in this environment, making the Salton Sea one of the crown jewels of avian biodiversity. A key point is that the avian biodiversity at the Salton Sea is influenced by events involving a much larger geographic area. The relative significance of the Salton Sea as avian habitat is reflected by approximately 70% of all the bird species ever recorded within California and more than one-third of all the bird species that breed in California being users of this ecosystem.

More than the number of species that use the Sea, it is the importance of the Sea for the sustainability of specific avian populations that needs to be considered. For example:

- This is one of the most important migratory stopovers and wintering areas in the world for eared grebes.
- During some years, nearly 40% of California's breeding by black skimmers takes place at the Sea.
- The Salton Sea nesting colony of gull-billed terns is the largest in the western United States and one of only two colonies that exist in this part of the nation.
- Approximately 40 percent of the United States population of the endangered Yuma clapper rail is dependent on the Sea.
- The Sea is one of the most important sites in the interior of North America for migratory and wintering shorebird populations and the populations are of international importance.
- Most of the western population of white pelicans utilizes the Sea during some years.
- The Salton Sea also supports the greatest number of western snowy plover in the interior of California.

In general, bird populations within the Salton Sea ecosystem on almost any given day number at least in the hundreds of thousands and at times are in the millions. All of this is being supported by agriculture drainwater.

CURRENT ISSUES AND NEEDS

Ecosystem Health

Despite the current abundance of fish and birds at the Salton Sea, this ecosystem is severely stressed. The visible evidence of stress is seen as massive fish kills, frequent algal blooms, and the high frequency and severity of avian mortality events. Clearly, the environmental quality of this waterbody is deteriorating.

From an ecosystem health perspective one might consider the Salton Sea as a patient with acute and chronic environmental health problems. Salinity is the acute problem and can be viewed as "high blood pressure" that will cause a fatal "heart attack" if not brought under control in the short term. That "heart attack" will result in the death of the fishery, thereby, eliminating the food base for fish-eating birds. The eutrophication problem and other aspects of water quality are chronic problems that can be equated to a slow growing cancer. They are already contributing to faunal health problems at the Sea by algal blooms and water column anoxia. Ultimately they will cause additional problems. If not adequately dealt with, those problems will also result in the "death" of the patient. How then should this agriculture system be managed to provide for its own sustainability as well as for the biodiversity of the fauna of the Salton Sea and associated environs?

Water, The Essence For Life

The "water war" skirmishes currently being fought at the Salton Sea can result in two basic outcomes. Water can be "liberated" from agriculture in a manner that provides continued opportunity for the environmental health issues just noted to be addressed. It can also be done in a manner that will prevent such efforts. It is possible to transfer water

currently allocated to agriculture within the Imperial Valley to metropolitan use without significantly impacting flows to the Salton Sea. Local interests are divided on this approach because it involves fallowing agriculture lands and the reallocation to the Salton Sea of some of the water associated with the irrigation of those lands. Other interests within society are also opposed to such an approach because it deviates from traditional regional uses of water. Many take the position that such actions are in conflict with the interpretation of Western Water Law established decades ago to serve Colorado River water users.

If the water transfer takes place in a manner that significantly reduces inflows to the Salton Sea it will rapidly degrade this waterbody by causing a rapid increase in salinity to a point where salinity control cannot prevent the fishery from being lost, and along with it the food base for the fish-eating birds of the Salton Sea. The associated degradation of the Salton Sea may also significantly impact air quality through fugitive dust and negatively impact the aesthics and economic well-being of this area in other ways. The resulting downward spiral of environmental quality could result in the Salton Sea being discarded as a viable and important ecosystem. That outcome would eventually minimize the role of agriculture within the Imperial Valley by providing enhanced opportunities for further withdrawal of water from the Imperial Valley to serve other needs within southern California.

The Path For Sustainability

Agriculture and wildlife interests at the Salton Sea can both benefit from becoming active participants and investors in a joint venture. Nevertheless, this will be difficult to initiate because too many are too focused on personal values and interests to appreciate the importance of the interdependency that exists and how those relations can benefit their interests.

The conversion of desert sands to agriculture commodities requires an investment of water resources whose long-term availability, despite historic precedents, is not assured in the competitive arenas of human values and the global marketplace. The increasing human population is resulting in increasing competition for land and water that is changing use patterns of the past for both resources. Currently, more than 2 million acres of rural land (including farmland) are converted to urban use each year (Environmental Defense 2001). These changes are in part facilitated by the global marketplace that provides the ability for people to satisfy their needs through goods produced in other countries and by economic situations associated with production and trade that influence what goods are profitably produced where. Therefore, if the only tangible products from the continued use of water in the Imperial Valley are agricultural crops, the continued use of that water for that purpose may be lost to greater economic returns.

However, without agriculture drainwater there will be no Salton Sea. The importance of the Salton Sea as avian habitat has been greatly elevated because of the massive losses of aquatic habitat within California and elsewhere. Therefore, the loss of the Salton Sea as suitable avian habitat will negatively impact numerous avian species. As a result, many

within the natural resources community will support water for agriculture to sustain the avian biodiversity of the Salton Sea. Other support exists because the fish and wildlife resources of the Salton Sea have economic values for local communities. They are also an environmental component that provides incentives for shoreline and associated economic development that can help to enhance the local and regional economies of the most economically depressed county in California.

Support for agriculture from these parties is dependent upon the biological resources and environmental quality of the Salton Sea being in a healthy state. Therefore, if agriculture is to benefit from the support of others in helping to sustain its activities it must be willing to make investments that benefit the segments of society that provide that support. The covenant that needs to be developed should have the sustainability of water for agriculture and the Salton Sea, the perpetuation of avian biodiversity, enhanced environmental quality of the waters of the Salton Sea and best-on-farm management practices as the corner posts for its foundation.

Wildlife interests must be willing to invest in a quality of drainwater that provides reasonable levels of health for those wildlife rather than water quality that meets human standards for consumption. A fundamental reason for this investment is the reality that human use of freshwater generally takes precedence over providing water for wildlife. Therefore, the survival of many species that comprise the higher life forms of our planet's biodiversity will continue to be severely water challenged under current conditions and projected additional withdrawal of freshwater for human use. Wildlife are

at the "end of the pipeline" in having access to freshwater and it is unrealistic to assume a change in priorities as the human population continues to increase and draw upon limited freshwater resources. Practicality demands that we make better use of our water if we are to preserve biodiversity, and ultimately ourselves. This must include reusing water to whatever extent is feasible.

A stark perspective on this matter is offered by Gleick (1993) who stated,

> "As we now look at the 21st century, several challenges face us. Foremost among them is how to satisfy the food, drinking water, sanitation, and health needs of ten or twelve or fifteen billion people, when we have failed to so in a world of five billion."

If we cannot satisfy the fresh-water needs of humans, how can we possibly satisfy the water needs for sustaining wildlife biodiversity? Part of the answer lies in the fact that agriculture accounts for about two-thirds of water use (Postel 1993). Regardless of what level of water conservation take place, providing food for the human population will always result in agriculture drainwater. The Salton Sea presents a unique opportunity to develop a joint venture between agriculture and wildlife interests that applies, on a large scale, our ingenuity and technology in a manner that uses agriculture drainwater to provide an additional array of major benefits, including the conservation of biodiversity. The transformation of this concept into sustainable systems that extend global water resources is important for agriculture, for the conservation of biodiversity and for the

well-being of human society. The Salton Sea ecosystem provides the testing ground for how to accomplish this.

CONCLUSION

The issues of the Salton Sea are contemporary issues of global scope for which there are no easy solutions. The increasing human population will continue to place increasing demands on water and other finite resources and to change natural and already human altered landscapes. As noted, because of the visions pursued by some the Imperial Valley of today stands in marked contrast to the landscape that existed a century ago. The Imperial Valley of a century from now will reflect the visions pursued today and tomorrow. Further, while

> "...the dreams of our times may prove ill conceived, we cannot live without them. The rescue of the Salton Sea, if attempted, will serve a vision of how the basin should be. It cannot be done otherwise." Also:
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> "The story of the future will be more like the story of the Salton Sea. It will concern society's efforts to live with and at times ameliorate the consequences of what was broken. We have entered an age of obligatory adjustment and repair" (de Buys and Myers 1999).

The need for adjustment and repair stems from what has become broken by our impacts on the environment and the integrity of the natural systems that provide essential services

and benefits needed to sustain human life and well-being. The obligations for adjustment and repair extends beyond our generation and our species for:

> "We do not inherit the earth from our parents, we borrow it from our children" (Anonymous).

Personal Credentials

Dr. Milton Friend

My name is Milton Friend and I am here to provide testimony relative to wildlife disease at the Salton Sea, specifically, avian diseases. My knowledge in this subject area has a foundation supported by the following considerations:

1. **Formal education**. I hold joint PhD degrees in Veterinary Science and Wildlife Ecology from the University of Wisconsin – Madison where I also minored in epidemiology. I also have a minor in epidemiology along with my Master of Science in Wildlife Management from the University of Massachusetts – Amherst.

2. **Work experience**. I developed the concept document for what is now known as the National Wildlife Health Center and served as the director for that program from its initiation in January 1975 until January 1999. That program is currently a component of the U.S. Department of the Interior's U.S. Geological Survey following relocation from the U.S. Fish and Wildlife Service. Previous employment within the wildlife health field involved the New York State Conservation Department (now the Department of Environmental Conservation) where I was the Project Leader for Wildlife Pathology and Physiology. I was also employed by the U.S. Fish and Wildlife Service, Denver Wildlife Research Center where I first served as a research biologist and then as Chief, Section of Pesticide – Wildlife Ecology. The cumulative experiences associated with these positions has provided a wide variety of opportunities to investigate and otherwise become involved in wildlife health issues throughout the United States and in numerous other countries.

3. **Professional stature**. In addition to serving as Director, National Wildlife Health Center for more than two decades, I am also an adjunct full Professor within the Department of Animal Heath and Biomedical Sciences, University of Wisconsin – Madison. I have taught diseases of wildlife within that Department for more than two decades and have also provided instruction for multiple years in wildlife health

courses in London, England and for a program sponsored by the University of Illinois and several other institutions. I have served as President, Wildlife Disease Association and in other capacities within the scientific community. I have also contributed numerous scientific papers and other publications including a field guide to wildlife disease that is used internationally. I am sought out to provide presentations, including keynote addresses, at scientific meetings and as a guest lecturer at universities.

4. **Salton Sea Experience**. I was appointed to serve as the Executive Director, Salton Sea Science Subcommittee at the 1999 initiation (December 1998) for the Salton Sea Restoration Project. That leadership role for science transitioned into becoming the Chief Scientist for the interim Salton Sea Science Office initiated in January 2001. I departed that position January 2002 to complete other obligations that were in place prior to my assignment to the Salton Sea.

The above experiences and educational training provides the basis for my comments and viewpoints relative to avian disease at the Salton Sea and elsewhere.

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