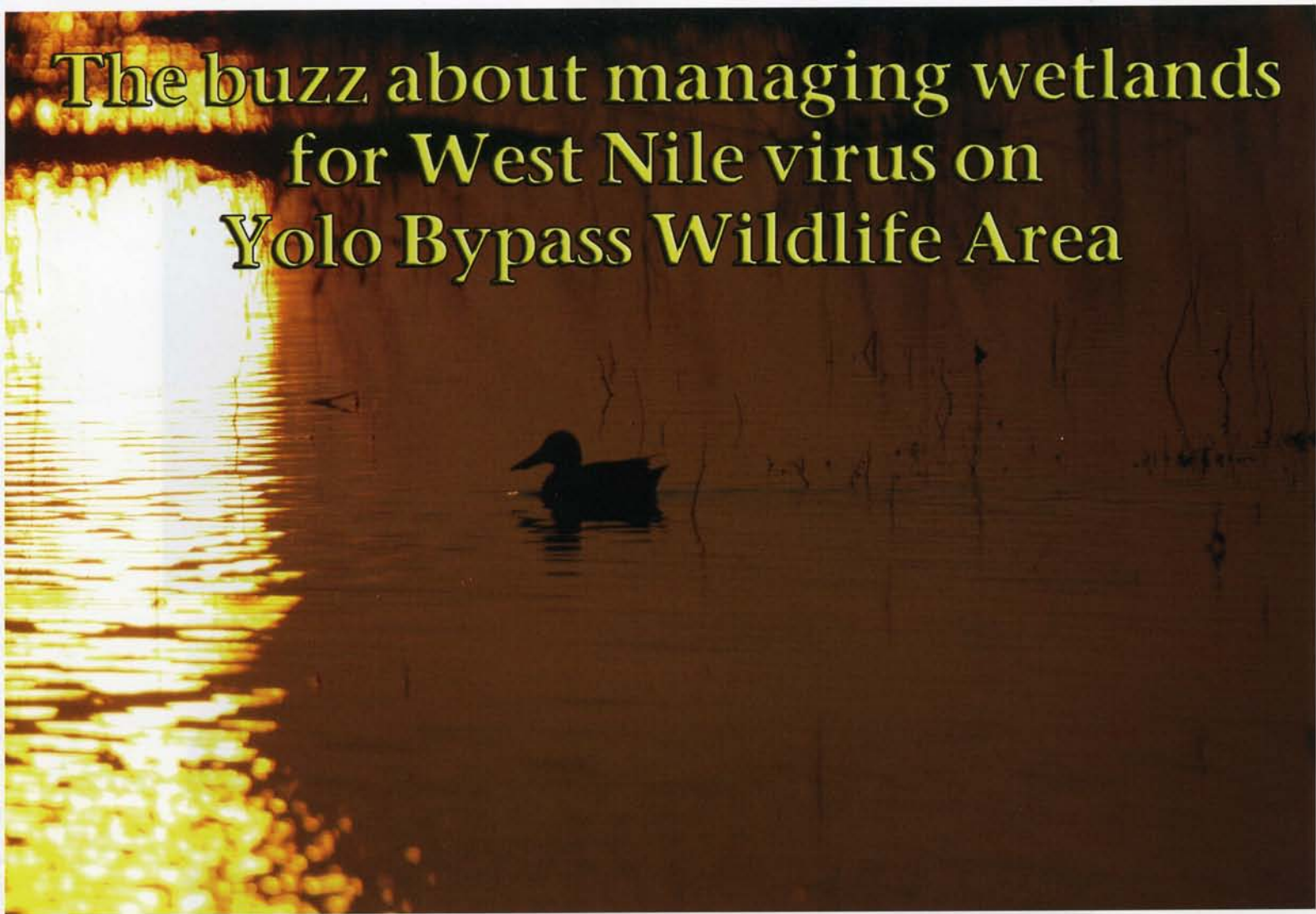


The buzz about managing wetlands for West Nile virus on Yolo Bypass Wildlife Area



Northern shoveler at the Yolo Bypass Wildlife Area.

DFG photo by Dave Feliz

“The plain is unhealthy and infested with mosquitoes in incredible numbers and of unparalleled ferocity.” – William Brewer, 1861.

Brewer, noted leader of the first geological survey of California, added this statement to his description of California’s Central Valley. For many years, this was what wetlands meant to northern Californians. These

By Dave Feliz

swamps harbored countless numbers of mosquitoes which carried devastating diseases such as malaria. At that time, the State of California owned most of the wetlands and eagerly encouraged its citizens to “reclaim” these lands to provide increased agricultural area and

eliminate their dangerous propensity to produce mosquitoes.

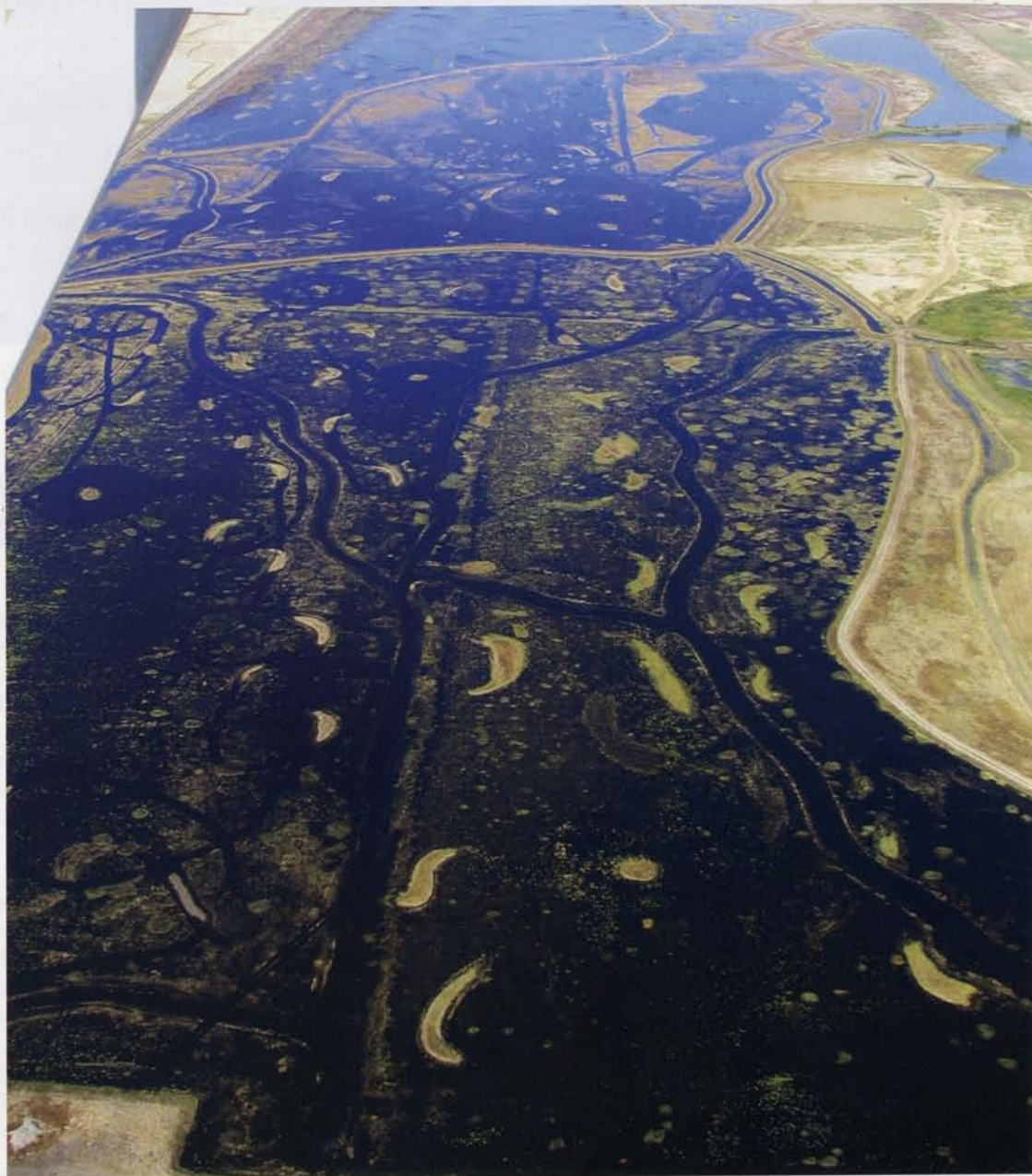
With only 5 percent of its original 4 million acres of wetlands remaining, the primeval Central Valley is only a memory, and its hydrology is largely dependent on the operation of man made water control structures. The vast Yolo Basin was converted into a flood conveyance facility that very effectively moves water from the Sacramento Valley to the Delta, especially in times of high flows.

When the founding members of the Yolo Basin Foundation began efforts to restore wetlands to the Yolo Bypass in 1989, the project’s potential to contribute

to the local mosquito population raised eyebrows, and rightfully so, considering the historic epidemics of the 1800s. Not wishing to revisit those troubled times, early discussions regarding the management of these proposed wetlands included the expertise of the Sacramento-Yolo Mosquito Vector Control District (SYMVCD).

A set of management measures was included in the operation manual for the Department of Fish and Game’s (DFG) Yolo Wildlife Area which minimizes the production of mosquitoes. The wildlife area staff have adhered strictly to these measures as area evolved into a complex that now exceeds 16,000 acres.

But a new threat has come to the





Top left, wetland enhancements, constructed during the summer of 2003, allow more efficient management of seasonal wetlands. Bottom left, northeast unit of Yolo Bypass Wildlife Area after fall flood up.

Above, geese fill the sky with numbers that have been impressive enough to slow traffic on Interstate 80.

DFG photos by Dave Feliz

Sacramento Valley - its name is West Nile Virus. The location of the Yolo Wildlife Area is critical with prevailing winds potentially carrying mosquitoes eastward from Yolo County to the urban center of Sacramento County. If there has ever been a location and a set of players where wetland habitat and a mosquito abatement district must coexist, this is it.

As much as West Nile Virus threatens humans, its outbreak will affect many wildlife species, especially birds of the jay family including western scrub jays, American crows and the Valley's endemic yellow-billed magpie.

Fortunately, progressive and forthcoming management at SYMVCD helps keep this from happening. Dave Brown of SYMVCD began talking to wetland managers in 2003 regarding the impending arrival of West Nile Virus. With the state budget crisis shrinking their operating budget, SYMVCD's ability to keep on top of the West Nile Virus situation became even more challenging. There was a very real possibility that wetland managers would have had to pay for the treatment of their wetlands.

The result would have been thousands of acres of valuable wetlands remaining dry while the fall flight of northern birds arrived to a valley void of flooded winter habitat.

But, it has not come to pass through cooperation and strong efforts by all parties involved. Wetland managers and mosquito abatement districts share a common aversion to mosquitoes. It does wildlife no good for lands to produce large numbers of mosquitoes. The larvae are not an important food source for water birds which prefer the midge, whose larvae are larger.

To build a sound and efficient mosquito management plan required identifying the different wetland habitat types, and the mosquitoes they would generate. Managed wetlands on the Yolo Wildlife Area fall into two general categories: permanent and seasonal wetlands.

Permanent wetlands and rice fields can be attractive to mosquitoes of the genera *Culex* and *Anopheles*. These can be collectively referred to as "Standing



Water Mosquitoes" since females will lay their eggs on the surface of standing water. These mosquitoes are the primary vectors for West Nile virus, Western Equine Encephalitis and historically, malaria. Permanent water is carefully monitored by SYMVCD personnel.

Fall flood up of seasonal wetlands needs to correspond with the arrival of migratory birds. These seasonal wetlands harbor large number of "floodwater mosquitoes" if irrigated in the summer and especially during the annual fall flood up. These types of mosquitoes include those in the genus *Ochlerotatus* and account for many of the public complaints due to their abundance and peskiness. This species is considered a moderately effective vector of West Nile Virus. Since these mosquitoes can develop from an egg into an adult in a little as three days, it is important to flood up quickly, so that a stable water level

can be reached and treated if necessary.

How DFG provides important fall and winter habitat for animals in these two types of wetlands without creating dangerous blooms of mosquitoes requires appropriate wetland design followed by careful water management using sound water control structures and diligent larvae abundance monitoring.

Many different measures are being implemented at the Yolo Wildlife Area. Whenever one of the ponds is flooded or drained, DFG informs SYMVCD ahead of time, so they will be able to monitor the production of mosquitoes in that pond. If treatment is necessary, the current primary control of choice is the bacteria *Bacillus thuringiensis-israelensis* (BTI). BTI settles in the water and is ingested by mosquito larvae. Toxins released by the BTI cause the larvae to stop eating and die. In addition to BTI, SYMVCD also uses

mosquito fish raised in its own ponds to control mosquitoes. Over 3,000 pounds of mosquito fish are planted each year in the 30,000 to 50,000 acres of potential mosquito-breeding habitat within SYMVCD boundaries. The fish feast on the mosquito larvae found in the ponds.

If a hatch of mosquitoes is produced, pesticides targeting adults are utilized. This is generally considered the least efficient way to control mosquitoes and is not specific towards mosquitoes only. Preventing mosquito larva from hatching in the first place is preferred.

Mosquito larvae occur in greater numbers in ponds with a high amount of vegetation. Open water ponds lack plant surfaces for eggs to adhere to, and wind blowing across the surface of the pond is exaggerated by the lack of vegetation to slow it down. Wetland managers can exploit this knowledge by removing



Page 12, top left, tractor and scraper constructing new levees with dirt taken from new swales. Top right, waterflow control devices help wildlife area managers maintain or adjust wetland levels at Yolo Bypass Wildlife Area. Bottom left, work crew assembled by California Waterfowl Association to construct wetland enhancement projects at Yolo Bypass Wildlife Area. Above, geese and other waterfowl take advantage of the wildlife area which sits along the Pacific Flyway, a major migratory bird route.

DFG photos by Dave Feliz

wetland vegetation through mowing, disking, burning or grazing.

In fact, studies at Grizzly Island Wildlife Area showed that ponds disked or mowed did produce smaller numbers of mosquitoes while increasing the production of midges. This type of vegetation manipulation is often coordinated with the sampling efforts of mosquito abatement districts in targeting problem areas.

Enhancements of existing wetlands in the Yolo Wildlife Area continue, and DFG shares its plans with SYMVCD to improve flood efficiency. Increased flood efficiency means DFG will have the ability to flood a pond within three days, and independently flood and drain each wetland cell. The shallow ditches will run from the intake of each pond to its drain, creating a great deal of variable topography while increasing the

efficiency and completeness of drainage capabilities.

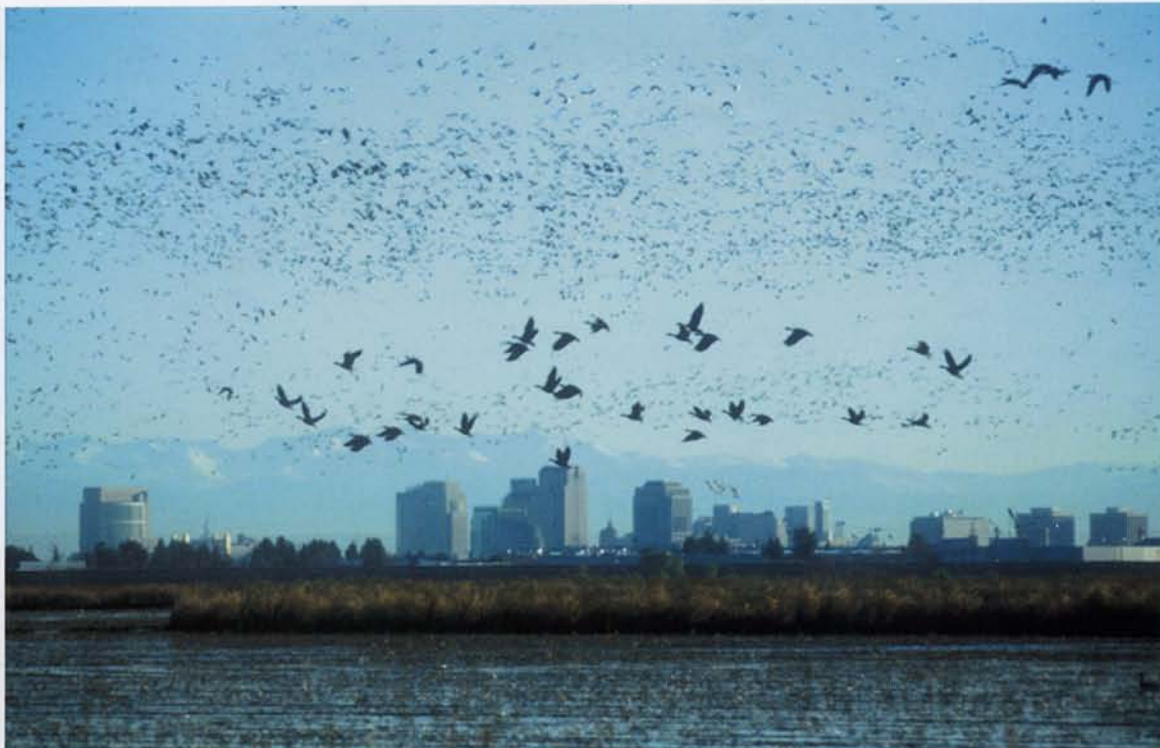
As the Yolo Wildlife Area expanded, it included irrigated fields of tomatoes, milo, rice, and pasture. The irrigation of pasture and production of rice presented additional challenges. Pastures irrigated without the knowledge of SYMVCD can produce dangerous numbers of adult mosquitoes, often well dispersed from their point of origin. Since rice is usually grown in water to control weeds, it can produce large numbers of standing water mosquitoes. So, Yolo rice fields are carefully monitored and treated as necessary. But, organic crops have specific restrictions on what can be applied to those fields while still maintaining their organic status, and this gives SYMVCD very few options for treatment.

There is a need for water throughout the year for the many birds that make use

of the Yolo Wildlife Area. In California, migration literally happens every month of the year. Northbound Wilson's phalaropes and resident black-necked stilts and mallards require shallow water well into the summer.

Meanwhile, by the end of June, the first shorebirds are returning to their Yolo wintering grounds after nesting in the perpetual summer daylight of the Arctic Coast. Yet, DFG knows that all activities to provide for these birds must include care and consideration for people. These seemingly disparate needs can both be met through the continued working partnerships like that of DFG and SYMVCD. 🐾

Dave Feliz is DFG's manager for the Yolo Wildlife Area.



Geese at Yolo Bypass Wildlife Area against the backdrop Sacramento.

DFG photo by Dave Feliz

West Nile Virus

In 1999, West Nile virus (WNV) appeared in New York City. After claiming the lives of innumerable crows and several humans, this mosquito-borne disease began its migration to the West Coast. Today, it's present in most California counties.

Although serious complications can result from a WNV infection (including life-threatening brain swelling), most people who contract the virus either experience mild clinical signs or remain unaffected. Typically, the severe form of the disease is restricted to young children, adults over 50, and immuno-compromised individuals.

Signs of infection include general body achiness, an elevated body temperature, and swollen lymph nodes. Individuals with the serious form of WNV may experience weakness of the muscles, neck stiffness, and debilitating nervous signs (including tremors, disorientation, and paralysis).

West Nile virus isn't the only insect-borne virus capable of causing disease in humans. Western equine encephalitis and California encephalitis, for example, are both spread by mosquitos and have the potential to cause permanent neurological damage. Vomiting, nausea, chills, and an elevated body temperature are typical early signs of infection.

The best defense is to avoid exposure to the bugs. Since mosquitoes require still water to reproduce, it's best to empty all water-containing vessels that are in the vicinity of the home (such as watering cans, wheel barrows, flower pots, and pool covers). Also, punch holes in the bottom of open-topped garbage bins to allow water to drain freely, and routinely unclog gutters and drains. To keep the house mosquito-free, window screens should be scanned regularly and repaired or patched as necessary.

Most mosquitoes prefer to glide in the still air of the night, so the nocturnal outdoor adventurer is advised to pack skin-concealing clothing, close-toed shoes, a mosquito-proof tent, and plenty of bug spray.

Kevin Schargen is pursuing a degree in veterinary medicine and surgery at Murdoch University (Perth, Western Australia). Look for an article from him on vector diseases in California in later issues or contact him at monotiti@aol.com.