Student project contributes to management and restoration e

The chance to restore a salt marsh is exciting, but when it comes at the cost of losing seasonally-flooded grassland heavily used by raptors, the prospect

By Matthew D. Johnson

becomes more complicated, or so the California Department of Fish and Game (DFG) and Arcata city officials have learned. A group of wildlife and city managers, with the help of a class project conducted by undergraduate wildlife students from Humboldt State University (HSU), are forging a plan to balance habitat for both salt marsh *and* grassland plants and animals.

Over the past 130 years, 87 percent of the salt marsh around Humboldt Bay in northwestern California has been converted to pasture, hay production, and city developments. Now, DFG and the City of Arcata have an opportunity to restore about 250 acres along the northern edge of the bay in an area known as McDaniel Slough. Together, they have proposed a salt marsh restoration project that involves breaching levees along the bay and allowing high tides to inundate McDaniel Slough with salt water. Tidal action will then naturally reintroduce salt marsh plants to the area and restore salt marsh habitat for shorebirds, fish, benthic organisms, and rare salt marsh plants such as the Humboldt Bay owl's-clover (*Castilleja ambigua* ssp. *humboldtiensis*).

The plan has not been universally praised, however, because an impressive, seasonally flooded perennial grassland has developed on the property since it was acquired in 1988 by DFG for wetland management. Studies conducted by HSU students have documented abundant rodent populations, including the highest densities of California voles (*Microtus californicus*) ever reported. Consequently, the area is an important hunting ground for several raptor species, especially the Northern Harrier (*Circus cyaneus*), the White-tailed Kite (*Elanus leucurus*), and the Short-eared Owl (*Asio flammeus*), and it is a popular destination for local bird watchers.

To help provide hard data to what at times has been a heated debate — raptors versus salt marsh — 25 students from HSU's Wildlife Habitat Ecology class and their instructor undertook an ambitious project to predict how wildlife might respond to the two management scenarios proposed for the area. The first scenario involved a narrow breach in the levee, creating a "muted" tidal flow into the salt marsh; the second included a wider breach and less restricted "full" flow. The students first used aerial photography, elevation maps, and topography survey data provided by city officials to predict how vegetation may respond to the different levee breaching proposals. Then, using a sophisticated computer software program administered by DFG called the California Wildlife Habitat Relationships System (CWHR), the students were able to compare and contrast how individual wildlife species respond to each scenario. The CWHR contains enough detail for users to

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marsh effort

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evaluate the relative benefits of various management scenarios, but it does not make value judgments about habitat suitability for wildlife in general. Finally, the students proposed a third scenario that could reach a compromise preserving habitat for raptors while providing salt marsh restoration.

The students' findings suggested that the muted-flow scenario would provide better wildlife habitat for the majority of the over 200 species listed as dependent on the area than a full-flow of tide water into the marsh. Under the full-flow scenario very little of the 250 acres would support plant life because much of the land inside the levees is too low in elevation. Instead, the full-flow option would create over 180 acres of *tidal mudflat*, a relatively abundant habitat around the bay. In contrast, the muted-flow scenario would result in the creation of about 90 acres of salt marsh, of which about 15 acres would be favorable for rare plants based on elevational distribution data. However, even this scenario would destroy grasslands and create over 120 acres of mudflats, so the students explored a third option.

Proposing a change in the arrangement of one levee to retain a strip of existing habitat on the western side of project, the students used the CWHR computer program to predict how wildlife might respond to their so-called Green and Gold scenario, named for HSU's school colors. This scenario would preserve almost 100 acres of grassland and still allow the creation of about 70 acres of salt marsh, nearly the same amount as under the muted-flow scenario proposed by Arcata and DFG. All of the roughly 15 acres suitable for rare plants would also be retained. Their results suggest that while wildlife would respond well to all three scenarios due to the creation of new wetlands habitats, the greatest benefit would come from the Green and Gold scenario, with over twice as many species positively as negatively affected. In particular, the students' scenario painted a comparatively bright future for animals reliant on grassland habitats (e.g., raptors and small mammals), which would likely be displaced by the other two scenarios. (Full details are available in a 50-page report, McDaniel Slough project, available on-line at *www.humboldt.edu/~mdj6/WLDF431.html*).

The City of Arcata and DFG are currently preparing environmental impact statements for the proposal. The exact arrangement of levees is still somewhat flexible, but they will likely follow the muted flow scenario fairly closely.

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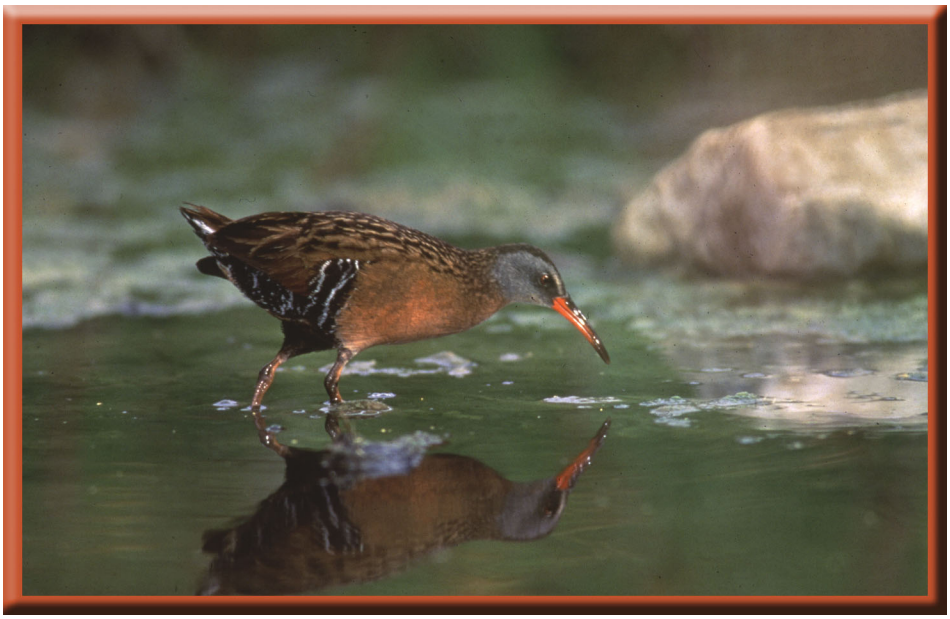
Above, terns.

Far left, Owl's-clover. Middle, grasses in the area. Right, slough in Humboldt Bay Area.



Virginia rail.

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Cedar waxwings.

Nonetheless, the students' scenario has the added benefit of potentially saving money by requiring less linear feet of new levee construction, and elements of their design may be incorporated into the final design. Construction is expected to begin in 2004.

Although all three scenarios would likely increase local wildlife diversity, some local citizens correctly noted that western salt marshes support fewer wildlife species, and more animals could be attracted to the area by creating *fresh* water marsh. Moreover, newly created salt marsh habitat will probably be colonized by non-native cordgrass (*Spartina densiflora*), a South American grass used little by native California wildlife. However, the students' report filed to DFG suggested that if the upper reaches of the marsh could be kept free of the invasive grass, endemic and rare salt marsh plants might be supported. And these plants, such as Point Reyes Bird's Beak (*Cordylanthus maritimus* ssp. *palustris*), make more substantive contributions to statewide biodiversity than do virtually any of the wildlife species because the animals are very widely distributed and comparatively common. Moreover, grasslands can and are being preserved elsewhere around the bay, whereas opportunities for salt marsh restoration arise in only a few places, such as at McDaniel Slough.

The students' results are intriguing, but they cautioned that many of their findings rely on a few assumptions, especially one related to the tidal elevations above which salt marsh plants can take root. They recommended that additional surveys by qualified hydrologists be conducted to better understand the elevation at which salt marsh plants can secure a foothold on tidal mudflats.

The project demonstrates that when universities, cities, and DFG work cooperatively, everyone can benefit. Using DFG's CWHR computer model, the students learned valuable skills useful for future employment, and their report will be helpful to the managing agencies as they plan and complete the project.

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List of species predicted to be positively affected by McDaniel slough change from current condition to "Green & Gold" scenario based on CWHR analysis (in order of increasing positive effect):

Townsend's Big-Eared Bat
Vagrant Shrew
Golden-Crowned Sparrow
White-Crowned Sparrow
Loggerhead Shrike
Merlin
Wrentit
Violet-Green Swallow
Red-Throated Loon
Red-Necked Grebe
Northern Mockingbird
Band-Tailed Pigeon
Horned Grebe
Brandt's Cormorant
American Kestrel
Tundra Swan
Fringed Myotis
Little Brown Myotis
Hairy Woodpecker
Chestnut-Backed Chickadee
Townsend's Warbler
Western Tanager
Bullock's Oriole
Common Porcupine
Northern Saw-Whet Owl
Red-Breasted Sapsucker
American Robin
Cedar Waxwing
Black-Throated Gray Warbler
White-Faced Ibis
Stilt Sandpiper
Rufous Hummingbird
Common Nighthawk
Ensatina
Pacific-Slope Flycatcher
Ash-Throated Flycatcher
Winter Wren
Cassin's Vireo
Macgillivray's Warbler
Yellow-Breasted Chat
Dark-Eyed Junco
Long-Legged Myotis
Hoary Bat
Dusky-Footed Woodrat
Foothill Yellow-Legged Frog
Ruby-Crowned Kinglet
Hermit Thrush
Varied Thrush
Northern Pygmy Owl
Raccoon
Ring-Necked Duck
Tree Swallow
Western Wood-Pewee
House Finch
Spotted Towhee
Pacific Giant Salamander
White-Tailed Kite
Short-Eared Owl
Anna's Hummingbird
Allen's Hummingbird
Willow Flycatcher
Hutton's Vireo
Bushtit
Mourning Dove
California Slender Salamander
Elegant Tern
Downy Woodpecker
Bewick's Wren
Swainson's Thrush
Warbling Vireo
Yellow Warbler
Black-Headed Grosbeak
Virginia Opossum
Great Horned Owl
Wilson's Warbler
Mallard
Bobcat
Lazuli Bunting
House Wren
Orange-Crowned Warbler
Wood Duck
European Starling
Red Knot
Western Fence Lizard

Photo © Brian Murphy

Anna's hummingbird.

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American Bittern
Long-Eared Myotis
Greater White-Fronted Goose
Eurasian Wigeon
Cinnamon Teal
Common Merganser
Spotted Sandpiper
American Pipit
Ruddy Duck
Hooded Merganser
Northern Rough-Winged Swallow
Western Terrestrial Garter Snake
Thayer's Gull
Black Phoebe
Green Heron
Oldsquaw
Heermann's Gull
Common Yellowthroat
Northwestern Salamander
Western Pond Turtle
Pacific Coast Aquatic Garter Snake
Northern Harrier
Rough-Skinned Newt
Common Loon
Barn Swallow
Long-Billed Curlew
Glaucous-Winged Gull
Mew Gull
Surf Scoter
Red-Breasted Merganser
Western Gull
Caspian Tern
Double-Crested Cormorant
Common Snipe
Semipalmated Plover
Ruddy Turnstone
Black Turnstone
Baird's Sandpiper
Pectoral Sandpiper
Red-Necked Phalarope
Red Phalarope
Redhead
Great Blue Heron
Belted Kingfisher
Greater Scaup
White-Winged Scoter
Herring Gull
Harbor Seal
Western Grebe
Clark's Grebe
Bonaparte's Gull
Cliff Swallow
Bald Eagle
Virginia Rail
Bufflehead
Common Tern
Osprey
Pied-Billed Grebe
Canvasback
Black-Bellied Plover
Whimbrel
Sora
Common Goldeneye
Marsh Wren
Killdeer
Northern Pintail
Great Egret
Brant
Wilson's Phalarope
Black-Necked Stilt
Pacific Golden-Plover
Long-Billed Dowitcher
Dunlin
Song Sparrow
Western Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
American Avocet
Northern River Otter
Ring-Billed Gull
Short-Billed Dowitcher
Least Sandpiper
Forster's Tern
Willet
Marbled Godwit
Eared Grebe
American Coot
California Gull
Black-Crowned Night Heron
Snowy Egret
American Mink

Racoon.

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