State of Our Infrastructure: Barely Passing

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Just as our nation's infrastructure is finally receiving federal and public attention, the American Society of Civil Engineers (ASCE) released its 2009 Report Card for America's Infrastructure—assigning it an overall grade of D and noting the need for a five-year investment of $2.2 trillion from all levels of government and the private sector.

ASCE assesses the condition and fiscal requirements of 15 infrastructure categories, including, for the first time, levees. Grades ranged from C+ for solid waste to D- for drinking water, inland waterways, levees, roads, and wastewater. The only area showing improvement since the 2005 assessment is energy (power transmission), which improved from D to D+. And since the 2005 assessment, the cost of improvements increased by more than half a trillion dollars. Water-related infrastructure received the following grades:

Dams: D (same grade as 2001, 2005) The number of deficient dams has risen to more than 4,000, including 1,819 dams with high hazard potential. Over the past six years, for every deficient, high-hazard potential dam repaired, nearly two more were declared deficient. The average age of the more than 85,000 dams in the United States exceeds 51 years.

Drinking water: D- (2001: D, 2005: D-) America's drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities and comply with existing and future federal water regulations. This amount does not take into account growth in the demand for drinking water over the next 20 years. Leaking pipes lose an estimated seven billion gallons of clean drinking water a day.

Wastewater: D- (2001: D, 2005: D-) Aging systems discharge billions of gallons of untreated wastewater into U.S. surface waters each year. The U.S. Environmental Protection Agency estimates that $390 billion is needed over the next 20 years to update or replace existing systems and build new ones to meet increasing demand.

Inland waterways: D- (2001: D+, 2005: D-) Of the 257 locks still in use on the nation's inland waterways, 30 were built in the 1800s and another 92 are more than 60 years old—well past their design life of 50 years. The cost to replace the present system of locks is estimated at more than $125 billion.

Levees: D- (new category) More than 85 percent of the nation's estimated 100,000 miles of levees are locally owned and maintained. The reliability of many of these levees is unknown. Many are more than 50 years old, built to protect crops from flooding. With increased development behind them, the risk to public health and safety from levee failure has correspondingly increased. The cost of repairing and rehabilitating the levees is estimated to be more than $100 billion.

ASCE proposed five key actions needed to address the situation:

- increase federal leadership in infrastructure;
- promote sustainability and resilience in infrastructure to protect the natural environment and enable it to withstand natural and manmade hazards;
- develop national and regional infrastructure plans that complement our broad national goals and focus on system-wide users;
- address lifecycle costs and ongoing maintenance to meet the needs of current and future users;
- increase and improve infrastructure investment from all stakeholders.

The 2009 Report Card was developed by 28 civil engineers collectively representing each infrastructure category and a broad spectrum of civil engineering disciplines. Each category was evaluated for capacity, condition, funding, future need, operation and maintenance, public safety, and resilience.

Visit www.asce.org/reportcard and www.cnn.com.

The Surprising Value of Saltcedar

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Saltcedar (*Tamarix*), an introduced shrub from Eurasia, has been part of the western landscape for a century and a half. Originally used as a hedgerow and to control erosion, it has spread to become the third most common riparian plant in the western United States, after cottonwood and willows. In the 1970s, ecologists and river managers became increasingly concerned that saltcedar was a detrimental plant—a prolific water user that outcompeted and displaced native trees and provided poor habitat for riparian animals including songbirds (Zavaleta, 2000).

Consequently, considerable effort has been spent trying to eradicate saltcedar throughout the Southwest, using aerially applied herbicides, mechanical removal, and a biocontrol agent, the beetle *Diorhabda elongata* (see sidebar). In 2006, the U.S. Congress passed an $80 million bill (HR 2720) for research projects aimed at controlling invasive saltcedar on western rivers. Although easy to kill, saltcedar is difficult to eradicate for the long-term.

However, studies over the past 20 years have not supported those earlier concerns (Stromberg and others, 2009). New methods of measuring plant water use over wide areas, based on moisture-flux towers and remote sensing, show that dense stands of saltcedar use 2.3 to 4.6 feet of water per year, with a mean value of 3.3 feet per year, about 50 percent of potential evapotranspiration (ET) (Nagler and others, 2008), whereas previous estimates by indirect methods were as high as 10 to 12 feet of water per year. Saltcedar water use is well within the range of native species. In one study, wide-area ET rates were compared on three river systems that differed in amount of saltcedar: the Upper San Pedro, where saltcedar is less than five percent of vegetation; the Middle Rio Grande, with about 30 to 50 percent saltcedar; and the Lower Colorado River, where saltcedar is more than 80 percent of vegetation. Despite the differences, all three had modest rates of ET, ranging from 2.6 to 3.0 feet per year. It now appears that little water can be salvaged by clearing saltcedar.

Photo: Tom Dudley, Marine Science Institute, UCSB

Tamarisk monoculture growing along the Virgin River in southern Nevada.

Recent ecological studies have shown that saltcedar does not compete directly with native trees. Instead, it tends to be a stress-tolerant species that replaces the natives when riverbanks and aquifers become too saline or dry to support them. Many western rivers are flow-regulated, with little or no overbank flooding to wash salts from the soil and replenish aquifers. As non-stress-tolerant native trees disappear from these rivers, saltcedar as well as stress-tolerant native shrubs tend to move in. Under a more natural flow regime, native trees and saltcedar either form mixed stands, or the native trees remain dominant (Stromberg and others, 2009).

Furthermore, the supposition that saltcedar provides poor wildlife habitat has undergone revision. Recent reviews (Stromberg and others, 2009) document widespread use of saltcedar by birds. Van Riper and others (2008) found that neotropical songbirds prefer a mix of plant species with cover of 70 to 80 percent saltcedar and 20 to 30 percent

Saltcedar, Beetles, and the Southwestern Willow Flycatcher

At a Colorado River symposium in November 2008, the U.S. Fish and Wildlife Service presented a handout titled “Not Wanted in Arizona—Tamarisk Leaf Beetles.” The handout noted that although federal environmental compliance for tamarisk-leaf-beetle releases in western states did not permit releases into Arizona or within 200 miles of occupied southwestern willow flycatcher nesting habitat containing tamarisk, releases by local agencies in southern Utah have allowed the beetles to move into Arizona. In addition, beetles that were not expected to persist at more southerly latitudes seem to be doing so without a problem. According to the handout, defoliation by the beetles will degrade the available habitat for the birds, and will occur during the height of nesting season, limiting reproduction.

In December the Center for Biological Diversity filed a notice of intent to sue the U.S. Department of Agriculture for failing to reinitiate consultation with the U.S. Fish and Wildlife Service about how to safeguard the southwestern willow flycatcher from the effects of the beetles, given the new information. Nevertheless, the organization supports the general idea of tamarisk eradication.

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native trees, while other studies show that the combination of as few as 10 to 15 percent native trees and proximity to standing water provides good bird habitat. On the other hand, Lovich and de Gouvenain (1998) noted that benefits to selected bird species do not necessarily extend to other animals such as reptiles, small rodents, and game animals. Although saltcedar monocultures may provide poor habitat for these species, habitat value tends to improve with the percentage of native trees.

The new challenge for resource managers is to reconcile the changing scientific perception of saltcedar with current aggressive control measures aimed at, and public support for, saltcedar removal. Without replacement vegetation, removal could result in habitat deterioration, but revegetating large areas is expensive, and native trees will no longer grow on many regulated river stretches. Biocontrol agents such as *Diorhabda elongata* are themselves difficult to control, and could do more harm than good on western rivers if saltcedar is definitively found to play a positive role in riparian ecosystems.

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