Faculty Profile

To: Dale Bartos
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Coming unglued

Wild elk are damaging some of Yellowstone Park's river systems, says hydrologist

Many land-management problems illustrate the blurriness of the boundary between natural and human-caused events. Consider the high elk numbers in the Northern Range of Yellowstone National Park from Bob Beschta's perspective.

On a visit last summer to Yellowstone's Northern Range, OSU forest hydrologist Beschta saw what he calls the "unraveling" of riparian and aquatic ecosystems along the Lamar River and other streams. The cause: long-term grazing by wild ungulates, mostly elk, that are using this portion of the park for their winter range.

The persistent grazing of the elk over many decades, says Beschta, has essentially eradicated the willows, cottonwoods, aspens, and other woody riparian plants that used to line the riverbanks and wetlands.

Normally, this vegetation has the function of anchoring a stream and preventing erosion during periods of high flow. These trees, along with sedges, rushes, and grasses, help build floodplains by catching and holding silts when the water overflows its banks. With the anchor gone, the banks are eroding and the streams are beginning to wander across ancient floodplains, cutting down through soil deposited over the last 10,000 years.

The normal course of this accelerated erosion is to destroy the diversity of the preexisting stream channels and their riparian systems. As the channel cuts deeper into the floodplain deposits, the water table is lowered, making it harder for the streamside trees and shrubs to get established again. "The system," says Beschta, "is coming unglued."

The loss of the streamside vegetation means loss of habitat and food for beavers, which were plentiful 100 years ago but are now almost gone from the streams and wetlands of the park's Northern Range. The loss of the riparian shrub communities also harms birds, small mammals, bears, and other wildlife.

The people's choice—and the consequences. *Bob Beschta in eastern Oregon (right and opposite page).*

The large elk herds that now frequent

the Northern Range are the consequence of a controversial change in national-park management philosophy. Before the 1960s, park managers had a policy of reducing elk numbers along the Northern Range by several means, including shooting some of the animals each winter. This policy succeeded in keeping the elk at manageable levels, but it raised a large public outcry and prompted congressional hearings.

Since about the mid-'60s, Park Service managers have followed a hands-off approach. The Park Service defends its philosophy by saying that the elk population, now at 100,000 or more across the greater Yellowstone ecosystem, is within its normal range of fluctuation. The system's natural checks and balances, they argue, will eventually trim the herd to a smaller size.

Beschta says no. The evidence of archaeological records and early historical records of the park area, he says, indicate that elk numbers before European-American settlement were not significant.

Also, during last summer's tour Beschta looked at the condition of vegetation within a number of fenced plots in the park. These enclosures were established for an experiment in the 1960s. Inside them, willows, aspen, and berry-producing shrubs are dense and herbaceous plants are diverse; the brush is often too thick to walk through.

Outside the fences is a stark contrast. The mature woody plants are gone, and new sprouts get only a season's growth before they're eaten. Because aspen reproduces from suckers, Beschta says, the relentless nibbling is destroying whole groves of it. The willows, cottonwood, and other woody plants are suffering a similar fate.

"The Lamar Valley looks like what would happen if you put 10,000 Herefords out there," he says. "The American public would never stand for that. But since the elk are native to North America, public sentiment and Park Service management policy has been to leave them alone."

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Beschta has spoken out before on the subject of grazing and streams. In 1987 he coauthored a landmark (and controversial) paper documenting the degradation of stream ecosystems on the high-desert rangelands east of the Oregon Cascades. He and BLM riparian specialist Wayne Elmore proposed restrictions in cattle grazing practices to restore the streams to health.

In a later study, Beschta and colleagues reviewed numerous fisheries-habitat improvement projects in eastern Oregon. They challenged the efficacy of instream structures—rip-rap, dikes, check dams, and the like—arguing instead that reducing grazing pressure and allowing riparian vegetation to recover was the best way to improve riparian and instream habitat conditions.

Similarly, if the streams of Yellowstone's Northern Range are ever to return to health, Beschta says, the Park Service will have to go back to some form of active management of elk numbers. However, he cautions that, as a general principle, active management should always be closely scrutinized. "The question managers need to consider isn't 'hands-on' versus 'hands-off,' management," he says, "but rather, if they're going to manage hands-on, what's their objective?"

He's all for active management to restore ecosystems if that's necessary, he says, "but the first thing is to stop doing whatever it is that's destabilizing the system. In the case of Yellowstone's Northern Range, that means changing how we use the land, and that means society's got to be involved in these restoration decisions. The public has to say what they want, and people have to understand the consequences of their choices."

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Focus on forestry

at Oregon State University

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Reshaping Forest Policy

OSU research looks at active ecosystem management

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Natural Resources Council Committee on
Ungulate Management in Yellowstone National Park
Board on Environmental Studies & Toxicology
HA-354
2101 Constitution Avenue, NW
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Dear Committee:

I would like to express my sincere appreciation at being able to accompany the Committee and the National Park Service in the field on Friday July 9 and to do a presentation before the Committee the following morning. I trust my presentation provided additional insights regarding conditions of existing channels and floodplains associated with the Lamar River and Slough Creek, and the causes of those conditions. Due to time constraints, I did not include companion information regarding Soda Butte Creek and the Gardner River below Mammoth where increasing levels of channel instability can also be documented.

In the time allowed for presentation, I attempted to provide a brief overview of riparian interactions between (1) vegetation, (2) floodplains and channels, and (3) hydrologic disturbance regimes. This was followed by a historical review of river channel and floodplain changes by comparing 1954, 1971-72, and 1991 aerial photography. Although additional aerial photos exist for some reaches in 1969 and 1988, they were not included in my presentation. My interpretations of the river changes illustrated in the aerial photos were based on my previous experience with long-term photo assessments and my understanding of riparian vegetation, hydrology, fluvial geomorphology, and the effects of land use. Published assessments that I have authored or co-authored include the Middle Fork of the Willamette River in the central Cascades of Oregon, the Kowai River on the South Island of New Zealand, and the Little Bighorn River in south-central Montana. In addition, I have spent time in the northern winter range of Yellowstone National Park for the express purpose of observing vegetation, soils, channels, and other riparian conditions associated with the Lamar River, Slough Creek, Soda Butte Creek, and the Gardner River. Based on the above observations, evaluations, and other information available to me, I would like to more formally submit several conclusions that I previously summarized during my presentation to the Committee on July 10, 1999:

(1) Loss of riparian woody species (multiple species of willows, cottonwoods, berry-producing shrubs, and others) along riparian areas of the Lamar River and tributary streams has been extensive and well underway before 1954.

Where shrubs are visible on the earliest aerial photographs, they consist primarily of mature clumps that tend to either become reduced in aerial extent or simply disappear

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over time. Other ground-based photos are available indicating the general loss and highlining of riparian woody species before 1954 as a result of heavy ungulate browsing.

(2) Loss of riparian woody species allowed the Lamar River and major tributaries to become destabilized and has initiated a major period of accelerated streambank erosion, increased channel widths, decreased sinuosity, increased amounts of braided channels, deposition of coarse sediments over former fine-textured floodplain surfaces, and other disturbance features.

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These conditions are clearly demonstrated in the aerial photographic record. They were not only becoming evident in 1954, but the effects have increased in rate and magnitude as is obvious in later aerial photographs (e.g., 1971/72 and 1991). This conclusion is also consistent with Dave Rosgen's Report (1993) to the NPS. Although the 1954 aerial photos are the earliest available, a 1941 aerial oblique photo exists of the Lamar Valley and shows the Lamar River to be comprised of primarily a single-thread (i.e., unbraided) and highly sinuous channel.

There was some expression by committee members that perhaps the Lamar River is simply doing what rivers do naturally–that is, most large rivers naturally migrate through time or shift locations across a valley bottom. However, it should be noted that the Lamar River has, in several locations, moved almost completely across the width of the valley in less than 50 years. At this rate, the Lamar River might be expected to migrate back and forth across the valley perhaps once a century. By any standard, such rates of channel change are incredibly high and can only be considered the result of a major perturbation, i.e., nearly complete loss of mature riparian shrubs as well as the hydraulic roughness and bank stability (through root strength) that these plant communities normally afforded. Furthermore, studies by Meyer et al. (1995, GSA Bulletin) indicate that periods of natural incision in the Lamar Valley during the Holocene were generally separated by thousands of years of general channel stability during which fine-textured sediments accrued on floodplains. The enormous extent of channel changes currently underway in the Lamar River and major tributaries, in spite of no major hydrologic or geomorphic perturbations from before 1954 to 1991, are totally supportive of the above conclusion. The fires of 1988, while providing additional sediment to alluvial fans for some of the relatively small and steep streams, may have contributed only slightly to the already unstable channel systems along the valley floor of the Lamar River and some of its major tributaries.

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There were also some concerns indicated by the committee regarding the role of "drought". Droughts in the western US are often identified in long-term climatic records as extended periods of relatively low precipitation amounts, sometimes in conjunction with high annual temperatures. However, while such measures of "drought" may be relatively meaningful to terrestrial vegetation, they are less important for riparian species. Riparian plant communities throughout the intermountain west are generally maintained by annual flood pulses (snowmelt hydrographs) that can locally

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scour banks or provide new seedbeds, that distribute plant propagules and seeds across floodplains, that recharge soil moisture, that deposit fine-textured sediments on floodplains, and that provide other functions conducive to the establishment, growth, and succession of riparian plant communities. It should be noted that historical peakflow records for the Lamar River indicate that annual peakflows during the "droughty 30s" were mostly near-average in magnitude. I know of no evidence to indicate that the flow regime experienced in the Lamar River system over the last 50 years and longer would cause the extent of riparian shrub and cottonwood community losses that have been occurring in that valley and its major tributaries. On the contrary, the flow regime of the Lamar River system has been largely unhindered by human actions and should thus be entirely supportive of sustaining riparian plant communities.

(3) It is my opinion, based on field observations in the northern winter range of Yellowstone National Park, interpretation of historical aerial photographs, an evaluation of literature related to the impacts of ungulate grazing in Yellowstone National Park, and previous field research in riparian systems and channels affected by ungulates, that restoration to approximately pre-1900 conditions for any woody riparian and upland aspen communities that currently remain in the northern winter range is not possible given the levels of ungulate herbivory that is occurring and that has occurred over many decades.

This is truly a sad commentary relative to the "natural regulation" paradigm. The local or basin-wide extirpation of cottonwood, willow species, aspen, berry-producing shrubs, and other riparian plants in the northern winter range will have untold effects on invertebrates, aquatic organisms, small and large mammals, birds, and other wildlife that depend upon a wide range of woody species and life stages to meet their habitat needs. Instead, it appears that the northern winter range is destined to become simply a "northern grassland" generally devoid of mature or late serial plant communities comprised of woody shrub species. I suspect that the scientific community and an informed American public will someday soon look back on the last 30 years of Park Service policy and be abhorred at how science was used to promote a policy of ungulate dominance (e.g., the American Serengeti) in an ecosystem that was previously more robust, more biologically complex, and more sustainable for a wide range of species.

Sincerely,

R L Beschta

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