Transformative, continued from page 21

Woody plant encroachment: Large tracts of grasslands and savannas have been converted to woodlands through a process often described as woody plant encroachment. These conversions result from a combination of factors, including overgrazing, reduction in fire frequency, and increases in greenhouse gases. They are likely to significantly affect the water cycle in terms of ecological processes and distribution of water across the landscape. In addition, there is good evidence that a shift from grasses to shrubs diminishes groundwater recharge—although not to a degree important for water supply. Little if any evidence suggests that woody plant encroachment has led to large-scale changes in streamflow, except where it is accompanied by degradation or desertification. Surface runoff and erosion will be significantly higher under degraded than nondegraded conditions. For example, Wilcox and others (2008) demonstrated that floods in west Texas in the earlier part of the last century were much greater than now because rangelands were much more degraded.

Looking Ahead

Understanding and mitigating the effects of transformative landscape change will dominate and transform land and watershed management in the future. The rich and diverse legacy of research into the relationship between vegetation management and water yields will provide a solid foundation for building new strategies to meet these future challenges.

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Business Directory

Native Trout, continued from page 27

Apache trout metapopulation (see map, page 26). The plan requires removal of some existing barriers and construction of a new barrier farther downstream on the West Fork, thereby increasing Apache trout habitat within the streams from 33.4 to 53.1 km. Although some downstream habitat may be warmer during summer, it will also contain deep, shaded pools that offer cooler refuges.

The new barrier will help isolate downstream non-native fishes from Apache trout. Non-native trout likely will have to be removed from the upstream area by chemical treatment. Regular stream monitoring will be needed to determine the relative status of native and non-native species as well as the effectiveness of barriers and control treatments.

State, federal, and tribal agencies typically lack sufficient funding to restore needed interconnected metapopulations such as in the West Fork of Black River. For Apache trout, the National Fish and Wildlife Foundation, Trout Unlimited, and other nongovernmental groups are providing additional support to create a few larger interconnected stream systems that complement existing recovery programs. These efforts may afford the best opportunity for native southwestern trout to survive a future that is past peak water.

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