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Buffelgrass—Integrated Modeling of an Invasive Plant

The USGS Fort Collins Science Center's Invasive Species Science Branch

Invasive, nonnative species of plants, animals, and disease organisms adversely affect the ecosystems they enter. Like "biological wildfires," they can quickly spread and affect nearly all terrestrial and aquatic ecosystems. Invasive species have become one of the greatest environmental challenges of the 21st century in economic, environmental, and human health costs, with an estimated effect in the United States of more than $120 billion per year. Managers of the U.S. Department of the Interior and other public and private lands often rank invasive species as their top resource management problem.

The Invasive Species Science Branch of the Fort Collins Science Center (FORT) provides research and technical assistance relating to management concerns for invasive species, including understanding how these species are introduced, identifying areas vulnerable to invasion, forecasting invasions, and developing control methods. To disseminate this information, FORT scientists are helping to develop websites to share invasive species information in partnership with Colorado State University (CSU). From these and other data, FORT scientists are constructing models to understand and predict invasive species distributions for more effective management. The data system and decision support tools presented in this fact sheet provide an exemplary case study on how the FORT is working to address the urgent issue of buffelgrass (Pennisetum ciliare) spread in the Southwest.

The Risks of Buffelgrass

Buffelgrass

Nonnative buffelgrass is an increasing challenge for land managers and private property owners. Buffelgrass is native to Africa, Arabia, Canary Islands, Indonesia, northern India, Madagascar, and Pakistan; it was brought to Arizona in 1938 for erosion control. Buffelgrass maintained low population levels until the 1980s when the occupied habitat of buffelgrass began to expand rapidly.

Dense stand of buffelgrass. Photo credit: Leonardo Frid

Buffelgrass growing on a rocky slope. Photo credit: http://www.buffelgrass.org/

Related Risks

Buffelgrass poses a problem in the deserts of the United States by growing in dense stands and introducing a wildfire risk in an ecosystem not adapted to fire. Other threats imposed include crowding out native plants and negatively affecting habitats of iconic native plant species such as saguaros and palo verdes, and native wildlife such as the desert tortoise. Fires in buffelgrass stands promote increased growth and establishment of buffelgrass, as it recovers quickly, colonizing the newly disturbed habitat, while native plants experience high mortality and are unable to recover.

In addition to creating concerns for native habitats, buffelgrass also presents a serious threat to life, property, and the regional economy of the Southwest. World class resorts and highly prized homes nestled among the saguaros are at risk to damage by wildfire, and tourist attractions, such as scenic desert walks, could go up in smoke. The vulnerability of critical and costly infrastructure, such as airports, power lines, and communication towers, puts the whole community at risk.

Southern Arizona Buffelgrass Coordination Center

The Southern Arizona Buffelgrass Coordination Center (SABCC) was developed to provide a regional information center that emphasizes an integrated approach to buffelgrass management in southern Arizona (http://www.buffelgrass.org/). The U.S. Geological Survey (USGS) has teamed up with SABCC to develop a data collection/management system for buffelgrass data and a buffelgrass decision support model.

Buffelgrass Decision Support Model

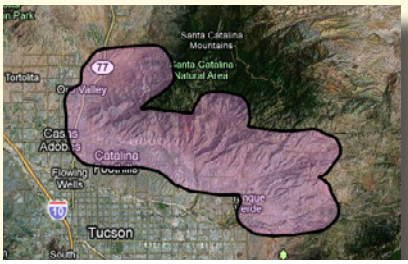
Given the urgency of the buffelgrass invasion and the limited resources available, land managers need tools to evaluate the potential efficacy of alternative mitigation strategies. The USGS worked in cooperation with ESSA Technologies (http://www.essa.com/) and SABCC to focus on the development of a spatially explicit model as a decision support system to evaluate potential strategies using buffelgrass infestations on the south slope of the Santa Catalina Mountains as a test case.

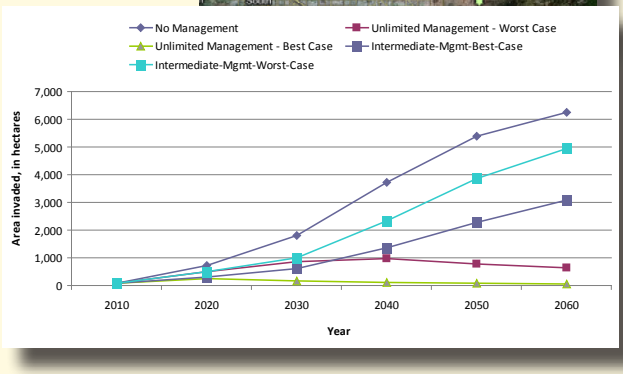
We ran a formal decision support/adaptive management simulation model to ask the following questions:

- What level of resources is required to prevent buffelgrass spread?
- How should these resources be allocated among inventory, treatment, and maintenance?

We found that without treatment, areas affected by buffelgrass will increase substantially over the next 50 years, but with early and effective treatment this area could be dramatically reduced. A large up-front investment in inventory and treatment could reduce overall management costs.

Study boundary for the Catalina Mountains north of Tucson, Arizona.

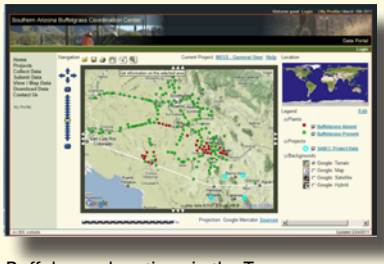




Results of five simulation scenarios showing the area in the Catalina Mountain study region invaded by buffelgrass over time.

Data Management System

The USGS, in conjunction with CSU, created a data portal as a "one stop" shop to submit, view, and download buffelgrass location and treatment data (http://ibis.colostate.edu/SABCC). The data stored in the portal have been contributed by numerous organizations, and the portal continues to grow and to share these data with other data repositories through web services, where appropriate. Upload options for data include shapefiles, KML files, geodatabases, and coordinate locations. Data in the data portal are partitioned by "projects," one for each partner organization. The complete buffelgrass dataset integrates data across all partner organizations and can be downloaded at any time.

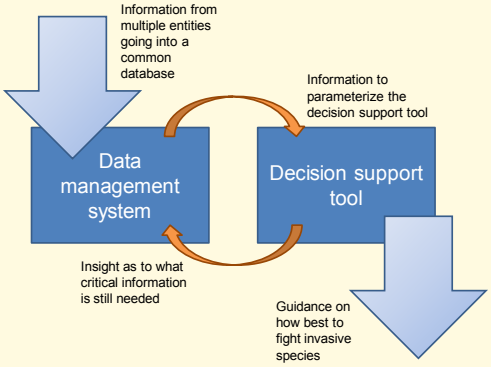


Buffelgrass locations in the Tucson area as shown on the data management system website (http://ibis.colostate.edu/SABCC).

Using This Effort to Guide Future Work by the USGS Fort Collins Science Center

The buffelgrass project provides a good demonstration of how the modeling team at FORT works collaboratively with multiple groups to leverage available data for modeling efforts; an important aspect of the FORT's approach is providing science support to manage invasive species. In this modeling effort, the FORT has developed complementary relations between a decision support system and a data management tool. The data management tool allows multiple agencies to supply critical information on the location and treatment of buffelgrass. This information, in turn, is used to set up the parameters in the decision support tool. Results from the decision support tool can be used to indicate which gaps in our current knowledge are most important in maximizing the management effectiveness of an invasive. Coming full circle, the data management system then can be used to gather this missing information. Together, these tools are helping to bring invasive species research to bear on multijurisdictional efforts to fight invasive species.

Work flow encompassing the data management system and decision support tool.



For more information contact:

Tracy Holcombe, Ph.D.
Ecologist
U.S. Geological Survey
Fort Collins Science Center
Invasive Species Science Branch
2150 Center Ave., Bldg C
Fort Collins, CO 80526-8118

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