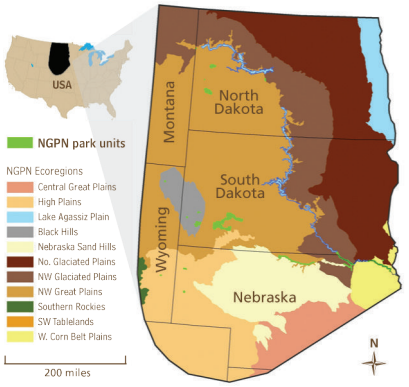
# NORTHERN GREAT PLAINS NETWORK:
# Using conceptual diagrams to aid communication

## Conceptual Diagrams Aid Inventory & Monitoring

The Northern Great Plains Network consists of 13 National Park Service park units from the Dakotas, Nebraska, and eastern Wyoming. Goals of the Network include: 1) monitoring park ecosystems to better understand their dynamic nature, and 2) integrating natural resource inventory and monitoring information into National Park Service planning, management, and decision making. The Inventory & Monitoring (I&M) Program provides guidance, funding, and technical assistance to complete a set of 12 baseline natural resource inventories for parks. These inventories serve as the baseline for establishing long-term ecological monitoring, known as "Vital Signs Monitoring."

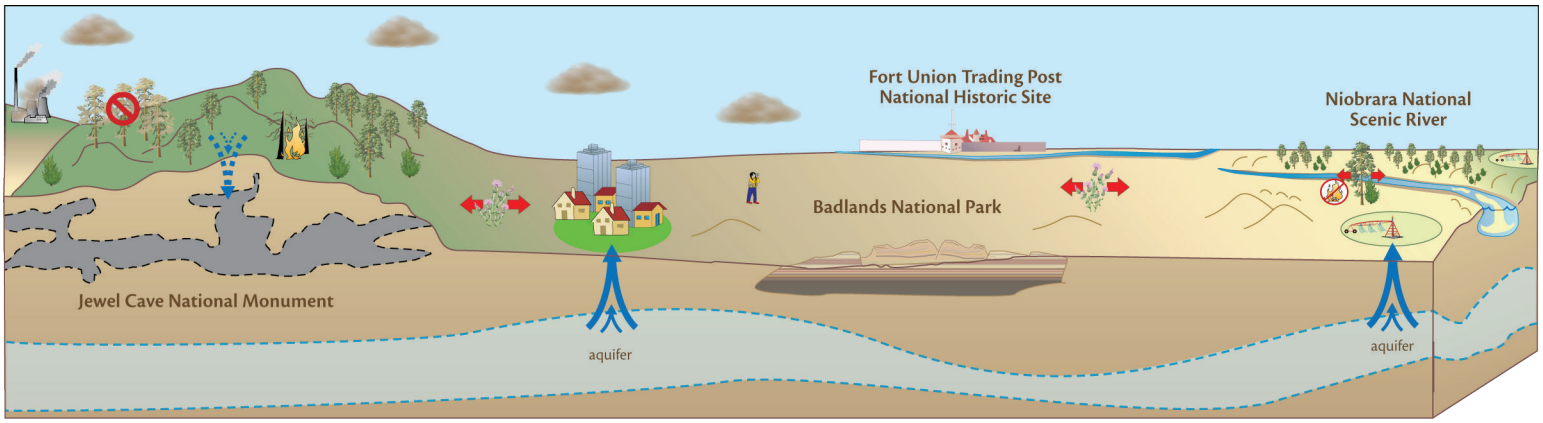
Conceptual diagrams, such as those presented in this newsletter, are a useful tool for both synthesizing and communicating complex ecosystem processes and features, and illustrating the role of monitoring. This newsletter presents the results of a pilot project that conceptualized key resources and threats of four diverse park units within the Northern Great Plains Network (NGPN). These diagrams will help communicate how inventory and monitoring relate to the resources and threats, and assist in tracking and communicating changes in ecosystem understanding as a result of the monitoring efforts.




*The 13 National Park Service units of the Northern Great Plains Network.*

## Generic Resources and Threats of Northern Great Plains Parks

This conceptual diagram illustrates key resources and threats that are generic to most, if not all, of the NGPN parks included in this project.




### Air

Ozone (smog) from distant coal-fired power plants has the potential to impact vegetation in the parks. The smog can bring health risks to visitors and cause poor visibility, impairing their viewing experience.

*Clear vistas are a key component of visitors' experience.*

### Fire

Grassland ecosystems depend on fire to maintain plant and animal diversity and to keep out encroaching trees and non-native grasses. Prescribed fire is used to prevent uncontrolled forest fires and manage ecosystems.

*Prescribed fire is used in the re-establishment of native grass species.*

### Water

Quality and quantity of surface water and groundwater is being impacted by activities outside and inside the parks. Water quantity is affected by factors such as dams, agriculture, and municipal water supply.

*Park water resources provide natural beauty and recreation.*

### Weeds

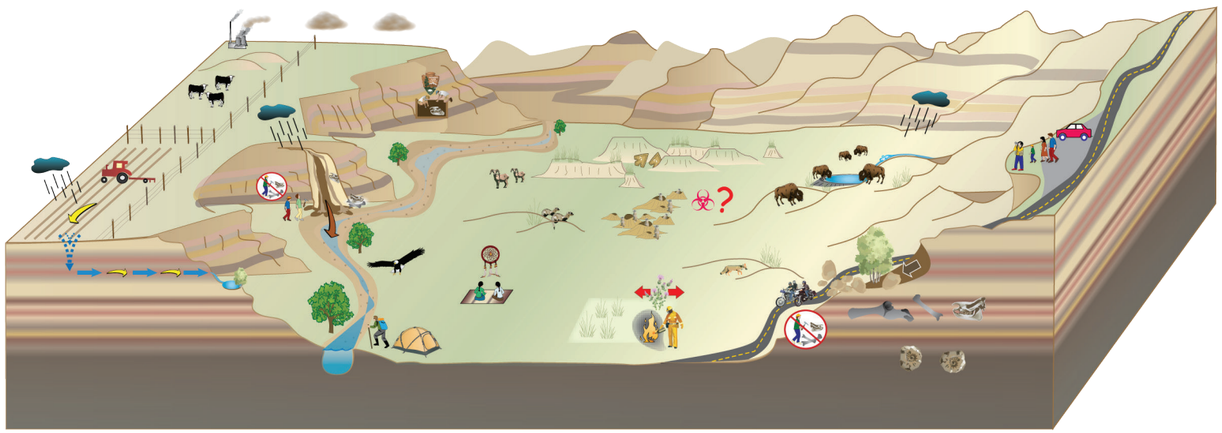
Invasive plants displace native plants and reduce habitat and food sources for native insects, birds, and other wildlife. Parks use fire, hand pulling, and biocontrol agents to combat invasive plants.

*Canada thistle is one invasive plant that is targeted for removal.*

# Four diverse park units in the Northern Great Plains Network

## *Badlands National Park: where paleontology, geology, biodiversity, and culture coexist*

The rugged scenic beauty of the Badlands National Park owes its origins to highly erodible, fossil-laden sedimentary rocks that form the distinctive pinnacles, gullies, and spires. Between the outcrops, mixed grass prairie supports many animals including bison, prairie dogs, and black footed ferrets. Threats to the park include illegal fossiling and the invasion of weeds and non-native grasses.



### *Natural & Cultural Resources*

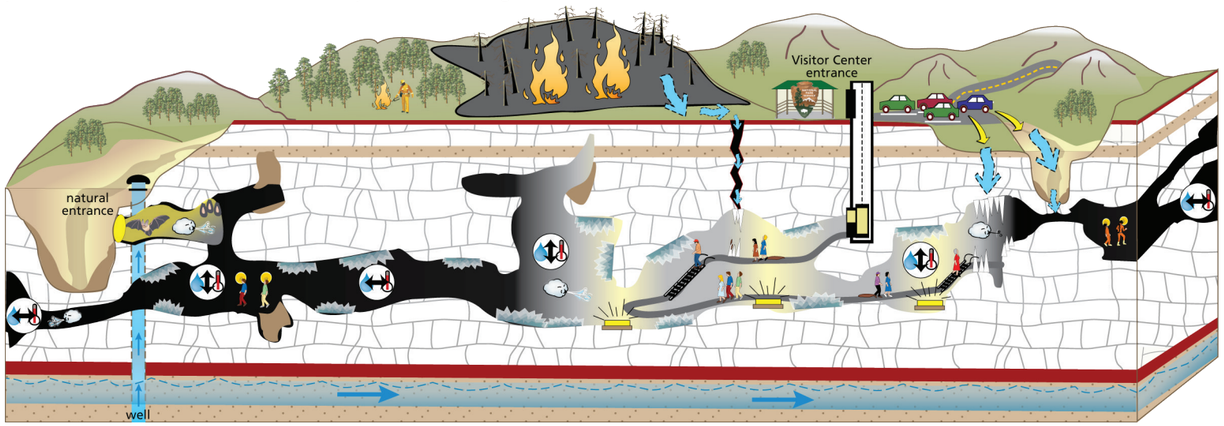
- Prairie grasslands & animals including reintroduced species
- NPS scientists recover globally significant fossil beds
- Marine fossils in Pierre Shale layer
- Current & historic Native American culture
- Unusual geology; slumping & erosion of friable rock layers
- Scenic beauty attracting visitors

### *Threats & Human Impacts*

- Spread of invasive plants; native grass restoration
- Potential for plague to infect prairie dog towns
- Illegal removal of fossils & historic artifacts
- Farm chemicals enter groundwater & emerge in springs

## *Jewel Cave National Monument: pristine cave formations with miles of unique habitat yet unexplored*

Jewel Cave, the second longest cave in the world, attracts many visitors who come to explore the calcite crystal-lined passageways. While the cave is largely in pristine condition, there are a number of potential threats that have to be carefully assessed, managed, and monitored. These include pollution of groundwater that seeps into the cave at various locations and the visitor impacts of changing ambient conditions and the introduction of foreign materials.




### *Natural & Cultural Resources*

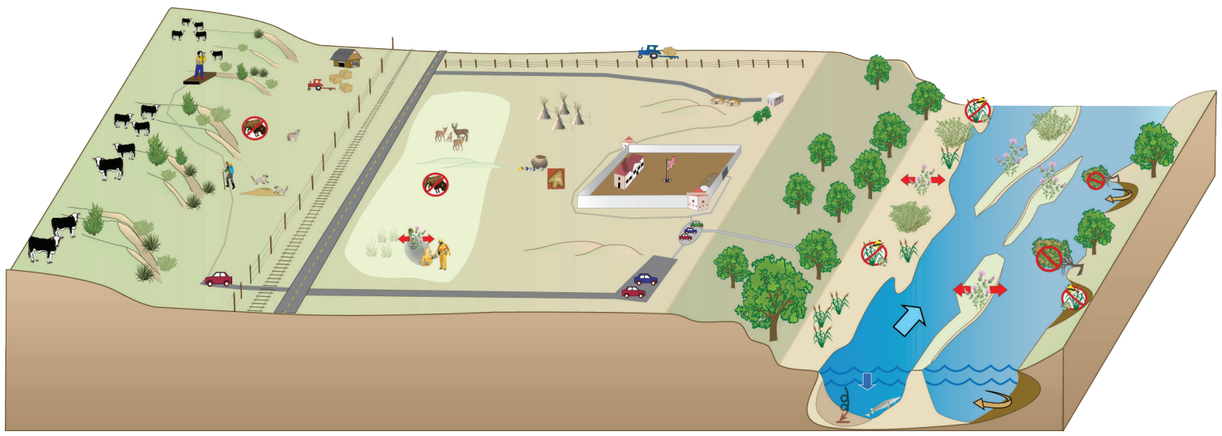
- Ponderosa pine forests of the Black Hills
- Cave tours & cave exploration
- Outside changes in barometric pressure create cave airflow
- Natural cave entrance provides shelter for several bat species
- Geological cave features such as calcite crystals & stalactites

### *Threats & Human Impacts*

- Prescribed fire reduces frequency of wildfires & ponderosa pine density
- Visitors introduce mud & lint altering cave environment
- Stormwater & pollution runoff from wildfires & roadways enter cave
- Cave humidity & temperature varies due to lights & visitors

## *Fort Union Trading Post National Historic Site: fur trade history brought to life*

Nestled along the banks of the Missouri River, Fort Union provides visitors a chance to experience life at an early 1800s fur trading post, prairie grasslands, and river-side habitat. Human impacts to this national historic site include loss of native grass species, invasive plants, and reduced river flow which is significantly altering riverbank flora and fauna. Efforts to restore and protect the site include planting of native grass species and prescribed fire to control invasive weeds.



### *Natural & Cultural Resources*

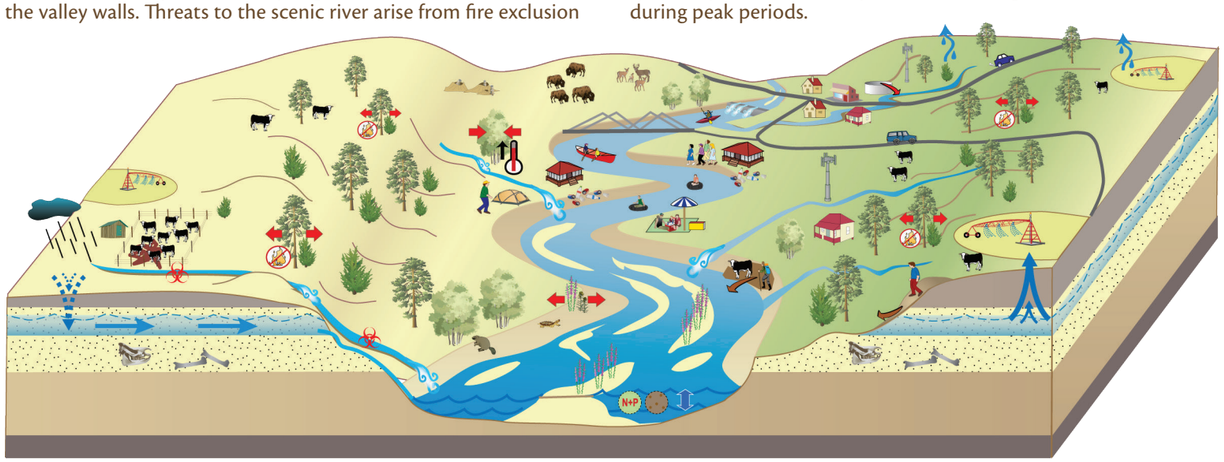
- Mixed grass prairies & coulees with native flora & fauna
- Clear vistas & opportunities for visitor hiking
- Archaeological sites of Euro-Americans & Northern Plains tribes
- Riparian areas with native flora & fauna
- Reconstructed trading post & living history programs

### *Threats & Human Impacts*

- Non-native plants & native grasses restoration using prescribed fire
- Altered river flow, bank erosion, & loss of native cottonwood trees
- Loss of native riparian areas, flora, & fauna
- Historic & current farming impact on landscape & native fauna

## *Niobrara National Scenic River: a wild and untamed prairie river with recreational opportunities*

The Niobrara is a scenic river where six major biomes converge to form a rich diversity of flora and fauna. The unique geological formations in the park lead to spring-fed streams that flow from the valley walls. Threats to the scenic river arise from fire exclusion leading to the expansion of ponderosa pine into grassland areas, changes in microclimates leading to loss of northern boreal tree species, spread of invasive plants, and the high volume of visitors during peak periods.




### *Natural & Cultural Resources*

- High biodiversity due to six over-lapping biomes
- Popular location for water sports & camping
- Globally significant fossils
- Geological layers leading to waterfalls, springs, & seeps
- Rural landscapes & historical sites

### *Threats & Human Impacts*

- Increased tree densities & grassland invasion by ponderosa pine & cedar
- Introduced weeds such as purple loosestrife, leafy spurge, & Canada thistle
- Nutrient & pathogen river input
- Native birch & aspen loss due to canopy & microclimate changes
- Change in hydrology: river flow & ground water
- Noise, littering, & soil erosion from recreational development

# Conceptual diagrams can provide synthesis and communication

The natural and cultural resources of National Park Service (NPS) Northern Great Plains park units are both diverse and complex. This diversity and complexity creates many challenges when establishing and running an effective Inventory & Monitoring (I&M) program, and when communicating resource condition results to users such as local and regional park management as well as park visitors. The conceptual diagrams presented in this newsletter provide an example of how park resources and threats can be summarized in a manner that is easy to understand and communicate. The diagrams were produced in collaboration with NPS staff from each park and therefore provide a summary based on their current collective knowledge and experience. These diagrams will not only be a useful communication tool for each park and the I&M program, but can be periodically revised and updated as the scientific basis for management evolves with additional monitoring. Overall, the collaborative process of summarizing and updating key features of the park will help ensure a common vision and understanding between I&M and the park, and facilitate the communication of this vision to visitors and managers alike.

## Inventory & Monitoring Program

- establish baseline information and detect trends in park resources
- deliver data and information on resource condition to park managers, planners, interpreters, and the general public

## Conceptualize key resources & threats

## Individual park unit

- preserve the natural and cultural resources and values of the park

*Rocky Mountain elk.*

## Shared vision & understanding

- shared vision and understanding of park resources and monitoring requirements and results

*Historic re-creation.*

*The Integration and Application Network (IAN) of the University of Maryland Center for Environmental Science (UMCES) provided the Northern Great Plains Network with an understanding of how conceptual diagrams can be constructed and used to communicate complex ecological principles, and held workshops to identify key issues and features of the four parks.*

### *NPS Participants (in alphabetical order):*

**Badlands National Park:** Rachel Benton, Megan Cherry, Josh Delger, Aaron Kaye, Brian Kenner, Greg Schroeder

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The National Park Service is implementing Inventory & Monitoring programs (http://science.nature.nps.gov/im) nationwide though a series of 32 networks. The Northern Great Plains Network (NGPN) is based at in Rapid City, South Dakota and coordinates biological and abiological inventories and long-term monitoring of natural resources found within the 13 park units. Additional Information on the NGPN can be found at http://www1.nature.nps.gov/im/units/ngpn/.

Nine university/research institutions and six federal agencies comprise the Chesapeake Watershed Cooperative Ecosystem Studies Unit (CW CESU; http://cesu.al.umces.edu). These partners provide leadership in watershed science and stewardship.


**FURTHER INFORMATION** NGPN: **http://science.nature.nps.gov/im/units/ngpn**
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