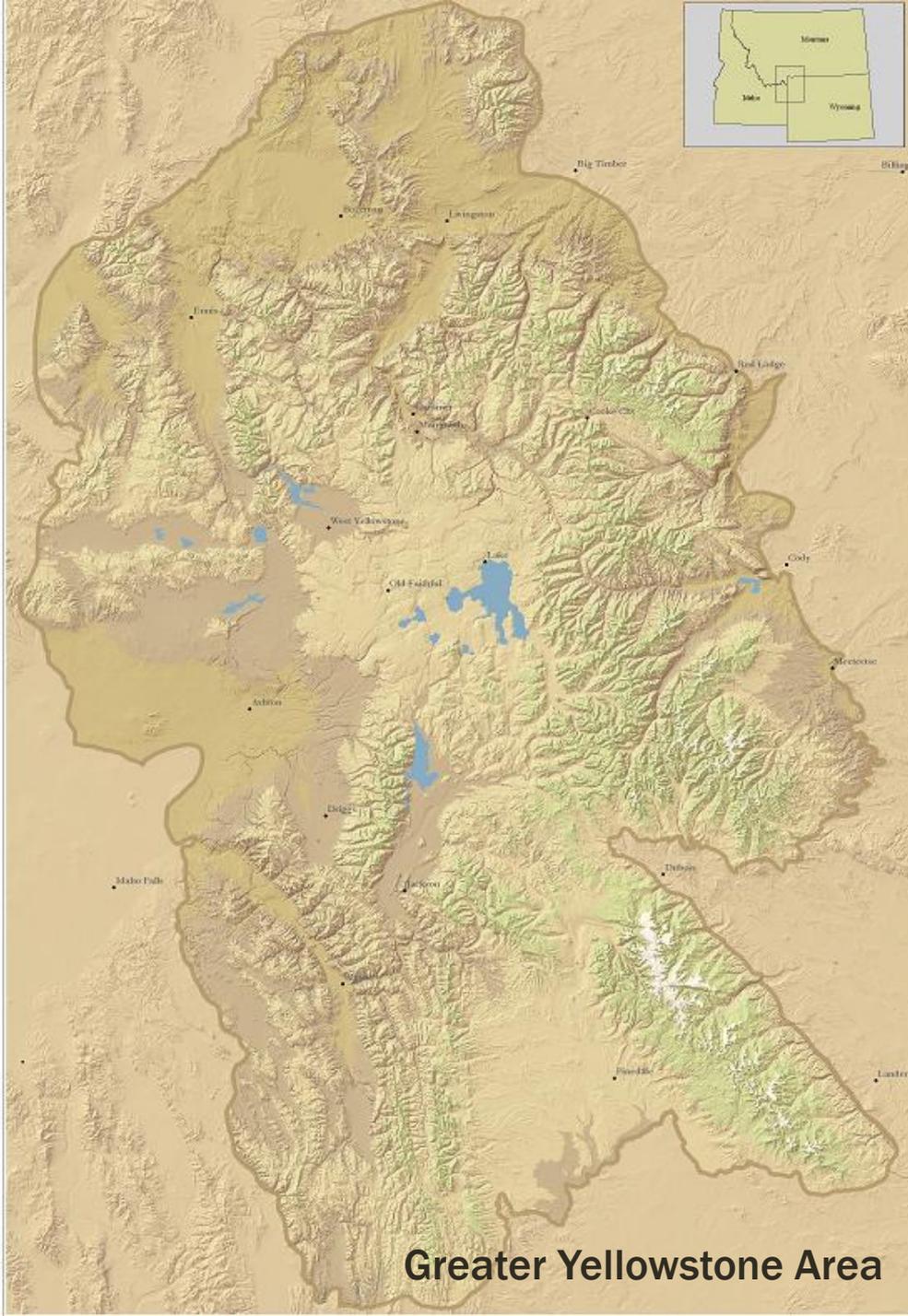


NCTC Climate Change Vulnerability Training

April 22-24, 2014

GREATER YELLOWSTONE WATERSHED VULNERABILITY ASSESSMENT

Virginia Kelly
GYCC Coordinator



Greater Yellowstone Area

The map displays the Greater Yellowstone Area, a large region in the western United States. The watershed boundary is outlined in a light brown color. The terrain is shown in shades of green and brown, indicating elevation. Major cities and towns are marked with black dots and labeled, including Big Timber, Billings, Livingston, Jackson, Park City, West Yellowstone, Old Faithful, Jackson Hole, Boise, Idaho Falls, Salt Lake City, Denver, and Lander. The map also shows the Snake River, Yellowstone River, and other major waterways. An inset map in the top left corner shows the location of the Greater Yellowstone Area within the states of Montana, Idaho, and Wyoming.

Greater Yellowstone Coordinating Committee

Mission: Facilitate cooperative management of the ecosystem



Greater Yellowstone Area



Park Superintendents

Grand Teton National Park & John D
Rockefeller Jr. Memorial Parkway – David Vela

Yellowstone National Park – Dan Wenk



Refuge Managers

National Elk Refuge – Steve Kallin

Red Rock Lakes Refuge – Bill West

Forest Supervisors

Beaverhead-Deerlodge N. F. – Melany Glossa

Bridger-Teton N.F. – Clint Kyhl

Caribou-Targhee N. F. – Brent Larson

Custer and Gallatin N.F.s – Mary Erickson

Shoshone National Forest- Joe Alexander, Chair



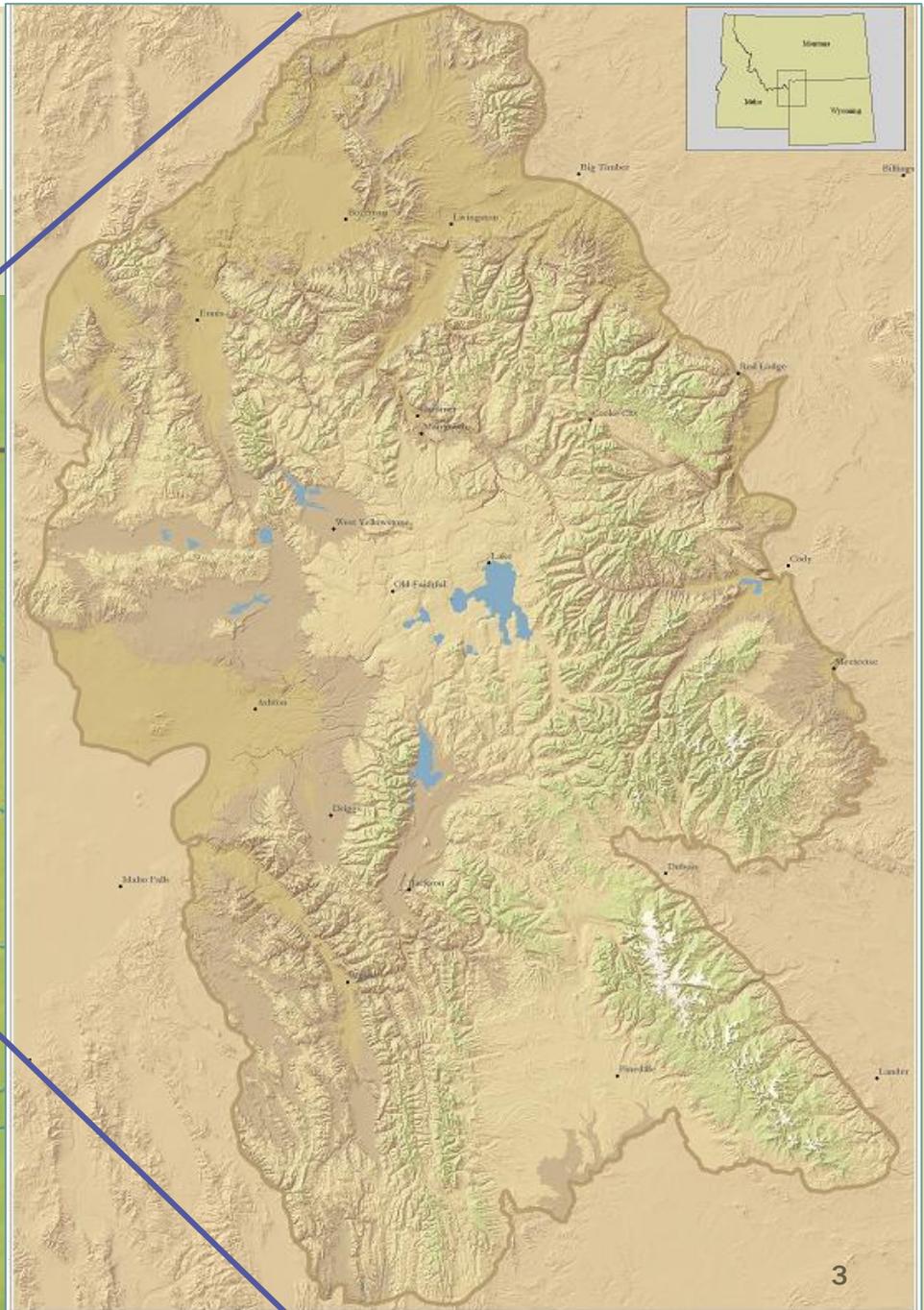
Bureau of Land Management

Idaho and Wyoming - Cody Field Office
Manager Mike Stewart

Montana – Western Montana District
Manager Rich Hoteling



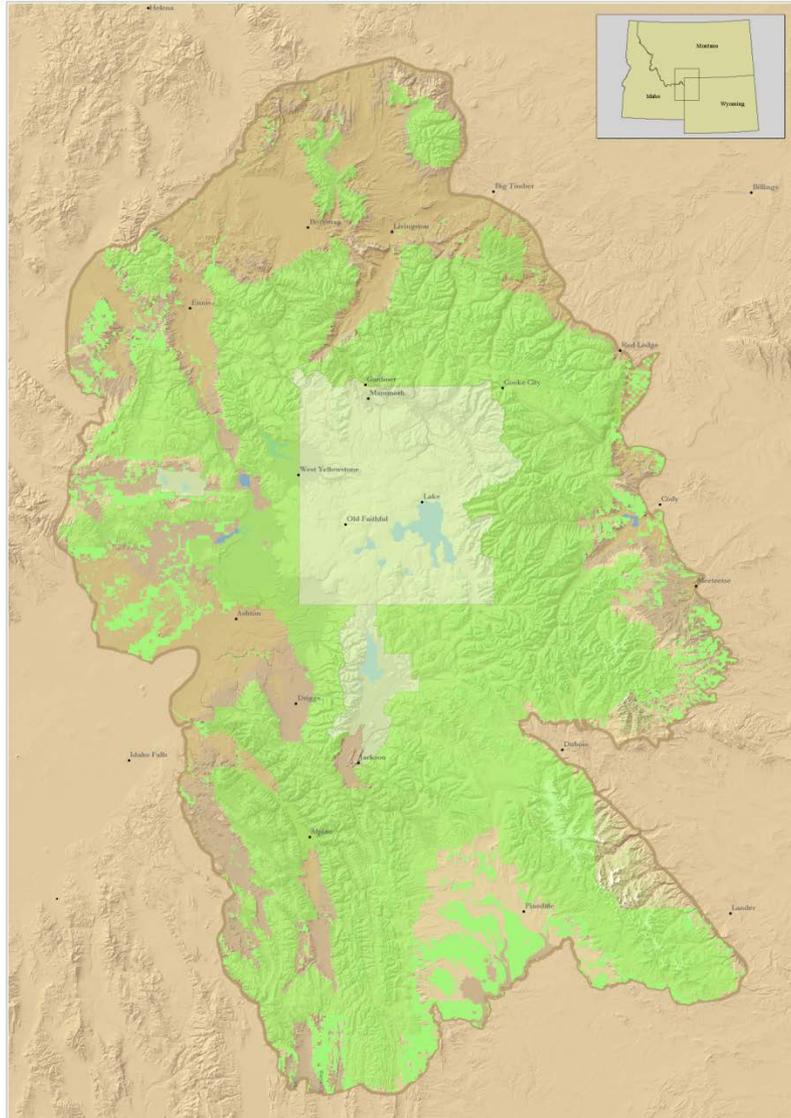
Greater Yellowstone Area
*Largest intact ecosystem
in the lower 48 states*



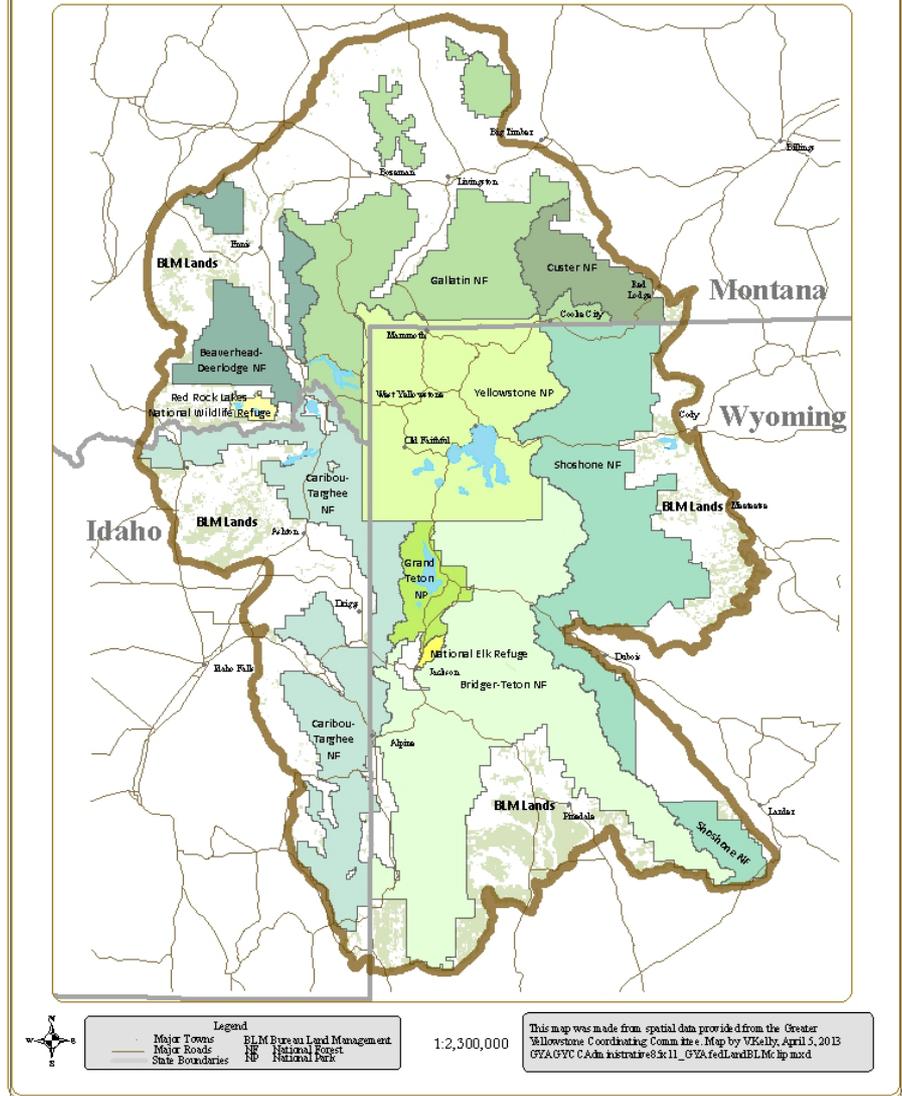
Greater Yellowstone Area

22 million acres. 15 million federal acres. Three States.

Greater Yellowstone Area Federal Land



Greater Yellowstone Area Federal Land Units



2014: GYCC 50 YEAR ANNIVERSARY



1964 - 2014



50 Years

Greater Yellowstone

Coordinating Committee



PRIORITIES

1) GYA – Wide; 2) Timely; 3) Benefits from Coordination

Ecosystem Health in the Context of Climate Change

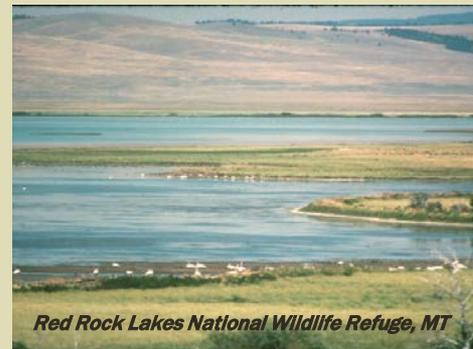


- Air Quality
- Invasive Species/Disease
- Species on the Brink:
Wildlife, Fish, Whitebark Pine
- Healthy Water Quality and Flow
- **Climate Change Adaptation**



Sustainable Operations

Connect People to the Land

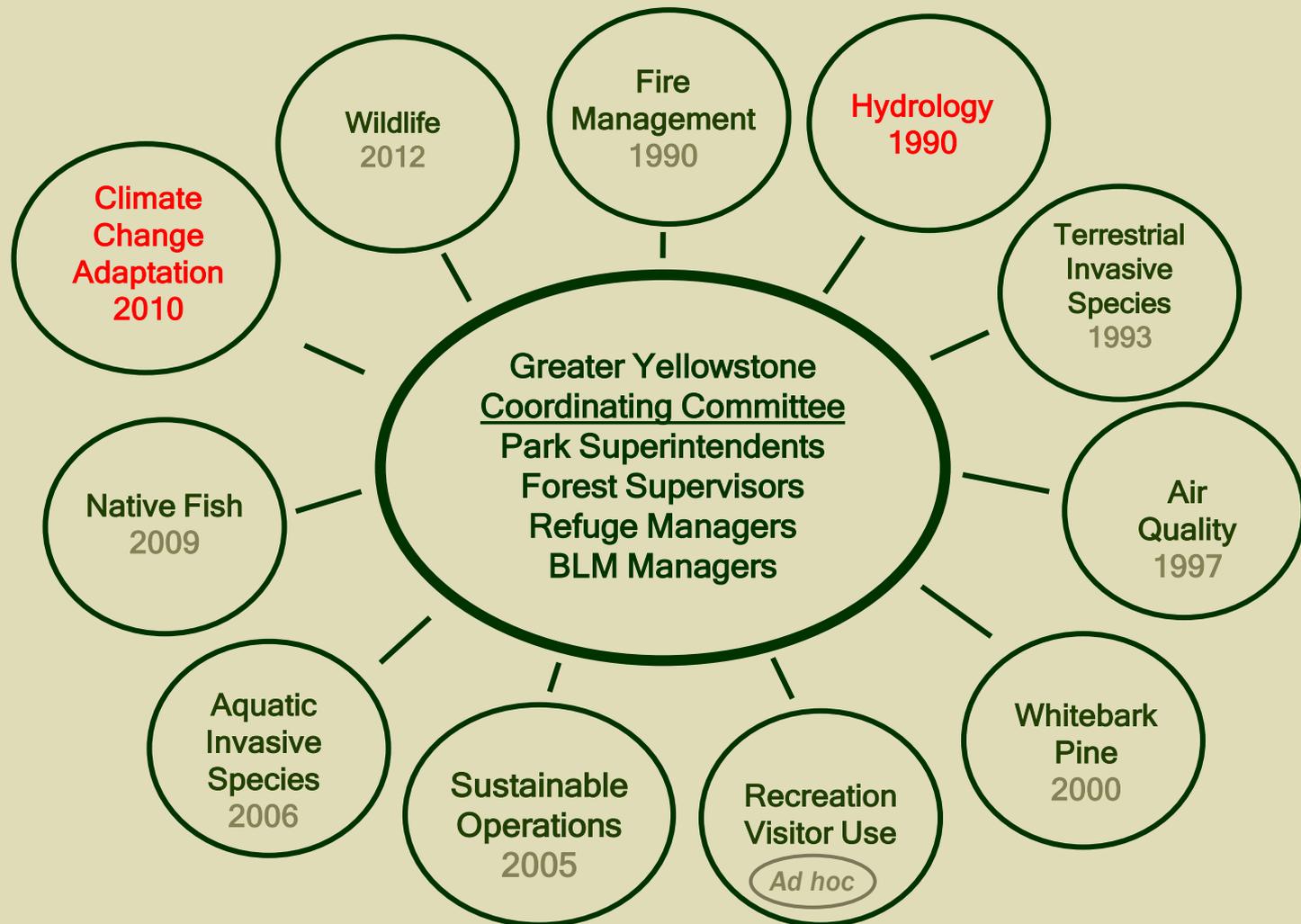


Red Rock Lakes National Wildlife Refuge, MT

Protect Greater Yellowstone Landscape Integrity

GYCC SUBCOMMITTEES

arranged by date of origination



FEDERAL LAND MANAGEMENT

How Much Existing Work is Informed by Future Climate Projections?



Road Maintenance



Trails



Planting



Fish Restoration



Forest Thinning



Weed Control

12 NATIONAL FOREST PILOT ASSESSMENTS



United States Department of Agriculture
Forest Service

Pacific Northwest
Research Station

General Technical
Report
PNW-GTR-884

July 2013

Assessing the Vulnerability of Watersheds to Climate Change

Results of National Forest Watershed Vulnerability
Pilot Assessments



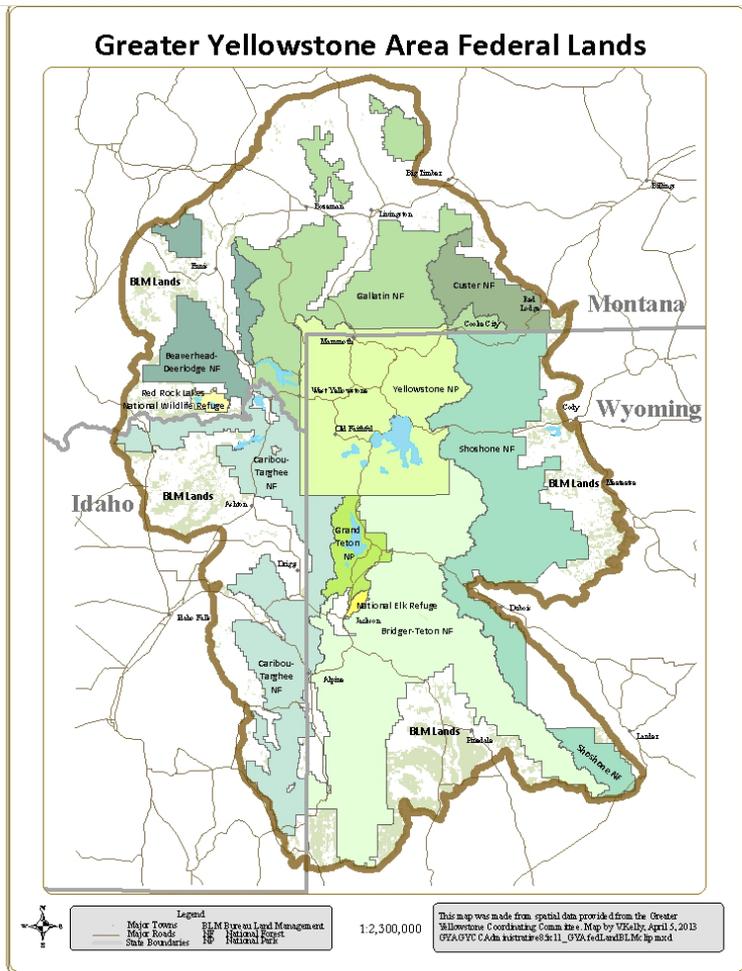
Gallatin NF

Emphasis on inherent sensitivity of the
land to climate change



CLIMATE CHANGE ADAPTATION

GYA WATERSHED VULNERABILITY ASSESSMENT



Tool to use climate projections as one factor to prioritize existing management actions

Start with hydrologic processes, can move to plants and wildlife.

–Infrastructure: roads, trails, campgrounds...

–Fisheries conservation actions: remove non-natives, place barriers

Can be used at GYA scale, and each unit can use it for their own decisions

GYA WATERSHED VULNERABILITY ASSESSMENT

DEVELOPED BY AGENCY STAFF

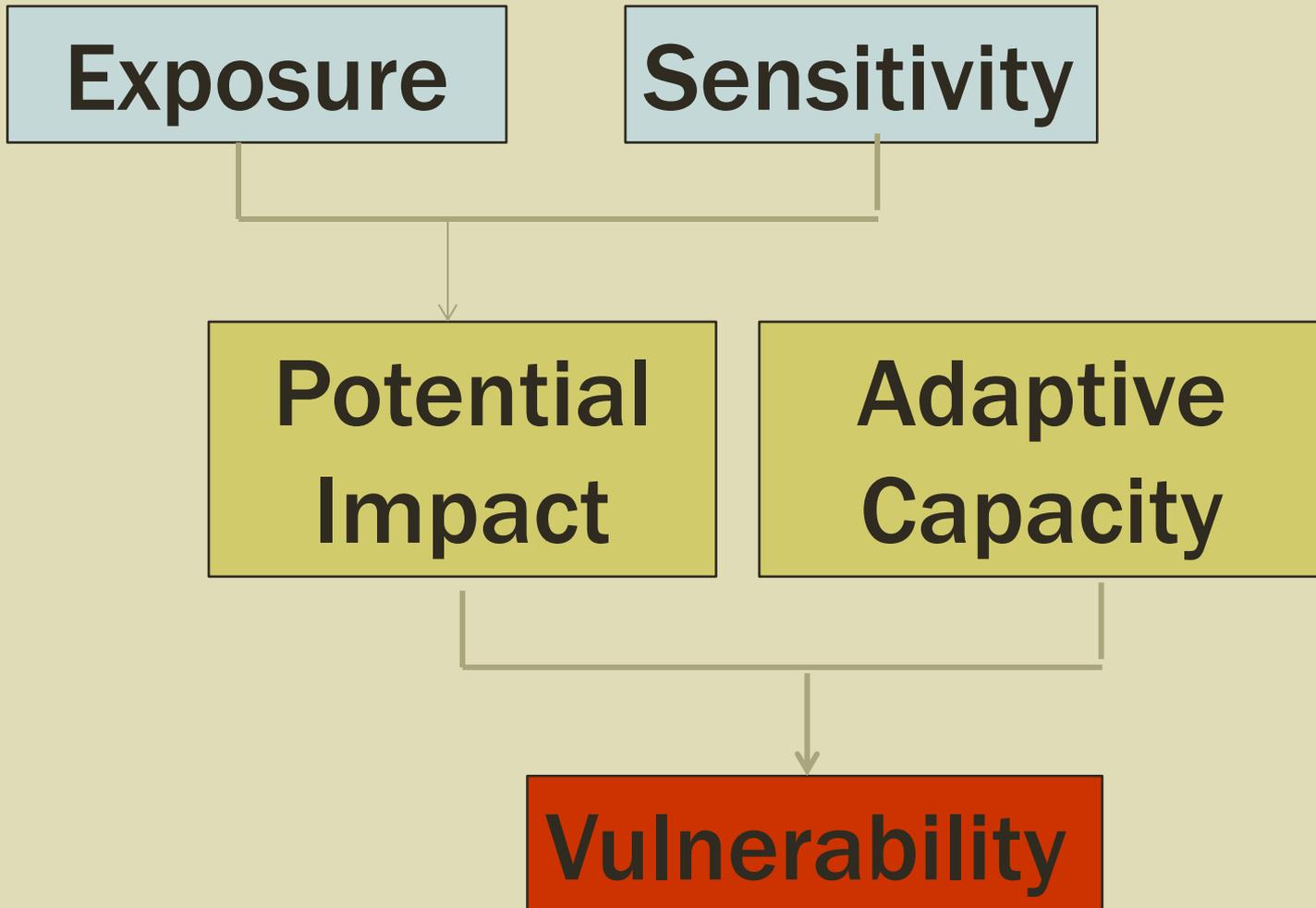
Hydrology Subcommittee Lead

Team

- Louis Wasniewski – Team Leader. Caribou-Targhee NF
- Tom Keck – Terrain Model Leader. Gallatin NF
- Ann Rodman – GIS Leader. Yellowstone NP
- Allison Klein – GIS. Yellowstone NP
- Kathy Mellander - Grand Teton NP
- Pam Fletcher – Beaverhead Deerlodge NF
- Eric Winters – Bridger-Teton NF
- Andy Efta – Custer NF
- Karri Cary – Shoshone NF
- Kyle Cutting – Red Rock Lakes National Wildlife Refuge
- Eric Cole – National Elk Refuge

CLIMATE CHANGE ADAPTATION

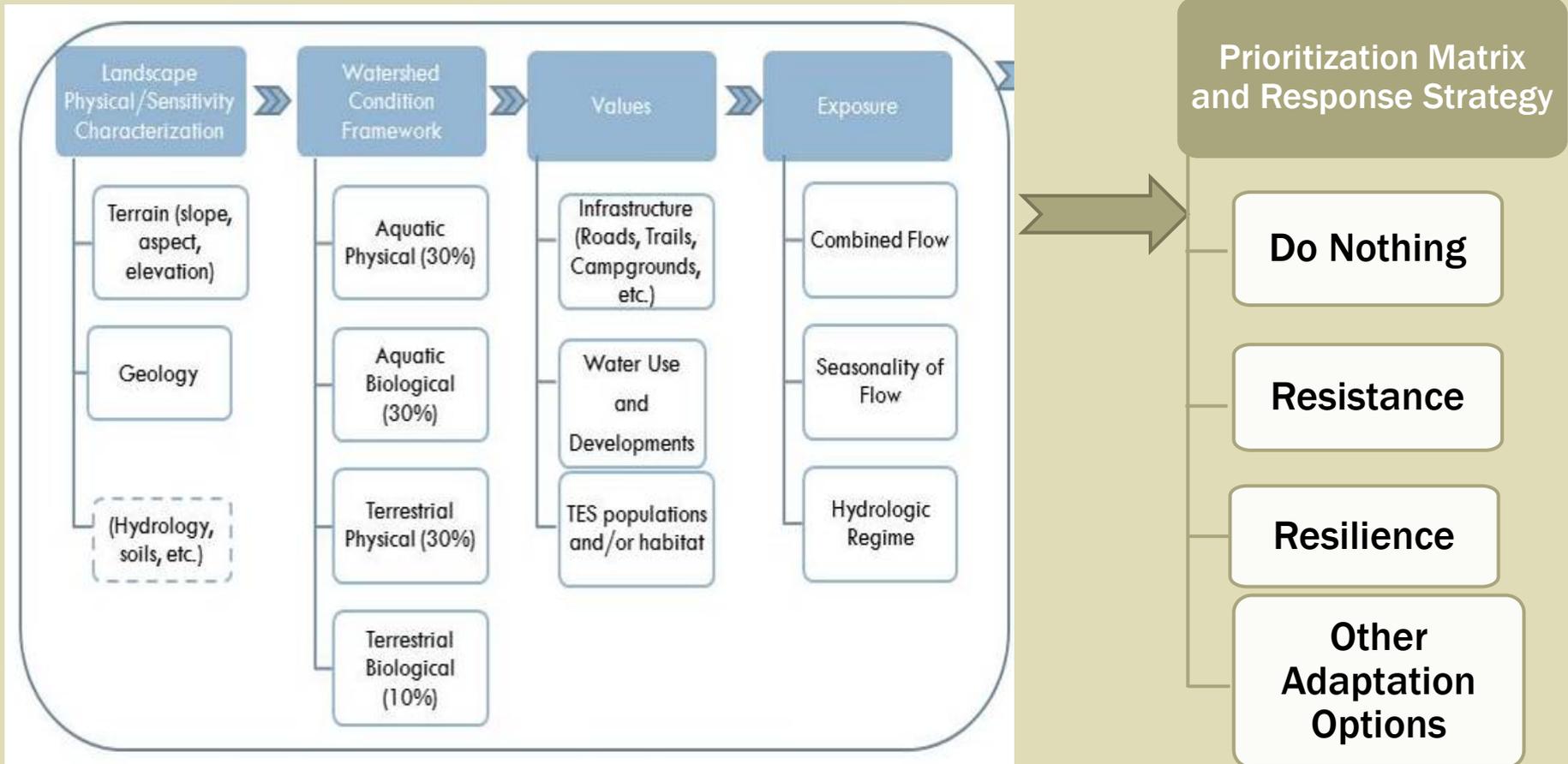
SCANNING THE CONSERVATION HORIZON



CLIMATE CHANGE ADAPTATION

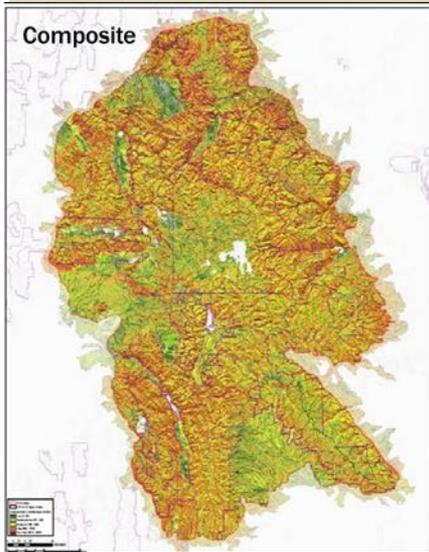
GYA WATERSHED VULNERABILITY ASSESSMENT

Objective: Climate Informed Management



GYA WATERSHED VULNERABILITY ASSESSMENT

SENSITIVITY / VALUES / CLIMATE EXPOSURE



Sensitivity Analysis

Based on
Terrain and
Soils/Geology



Infrastructure
Native
Coldwater Fish
Stream Ecology



Values
(More can be
added in
future)



Combined Flow
(Base +Runoff)

Snowpack
vulnerability
Base Flow
Average
Summer Air
Temperature

Climate Exposure
(More can be
added in future)

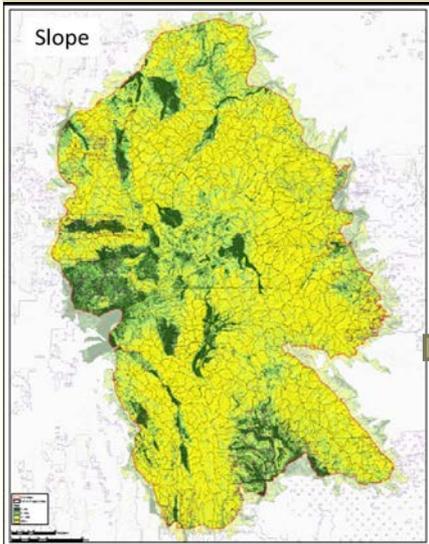
Map of 6th Code
HUC watersheds
with **relative**
ranking of
vulnerability to
climate change.

Informs
management
actions, priorities

Result:
Summer 2014

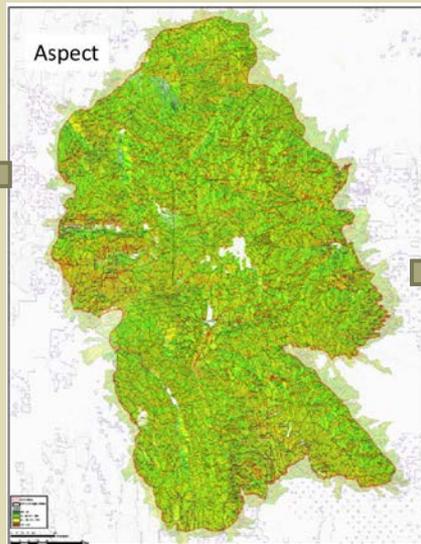
GYA WATERSHED VULNERABILITY ASSESSMENT

SENSITIVITY (REACTIVITY) ANALYSIS

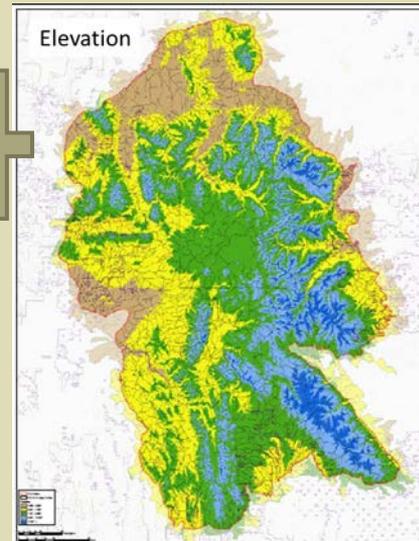


Slope: Steeper = more sensitive (yellow)

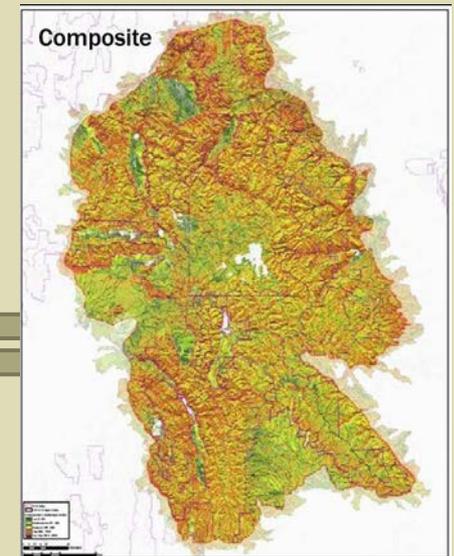
30 meter DEMs



Aspect: South = more sensitive (red)



Elevation: Lower = more sensitive (tan)



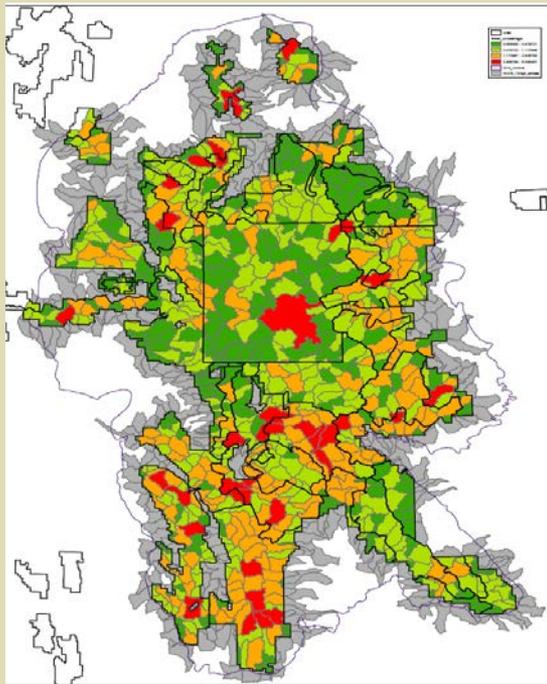
Composite red = more sensitive
We will add underlying geology / soils

GYA WATERSHED VULNERABILITY ASSESSMENT

VALUES:

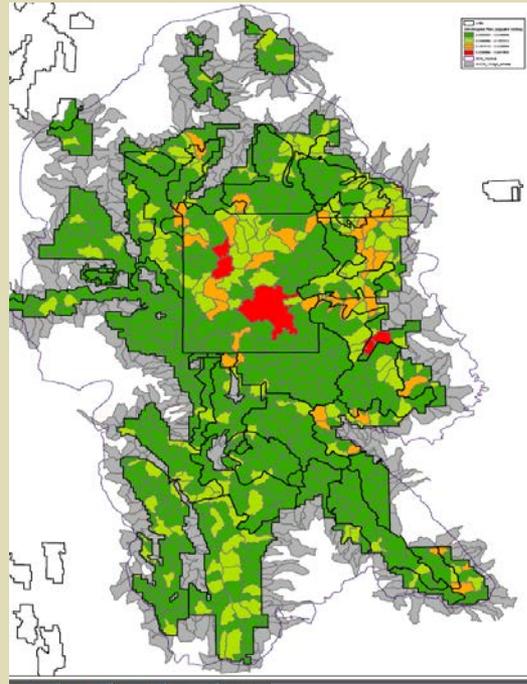
Infrastructure, Native Coldwater Fish, Stream Ecology

Infrastructure: Roads, Trails, Structures in Riparian Areas



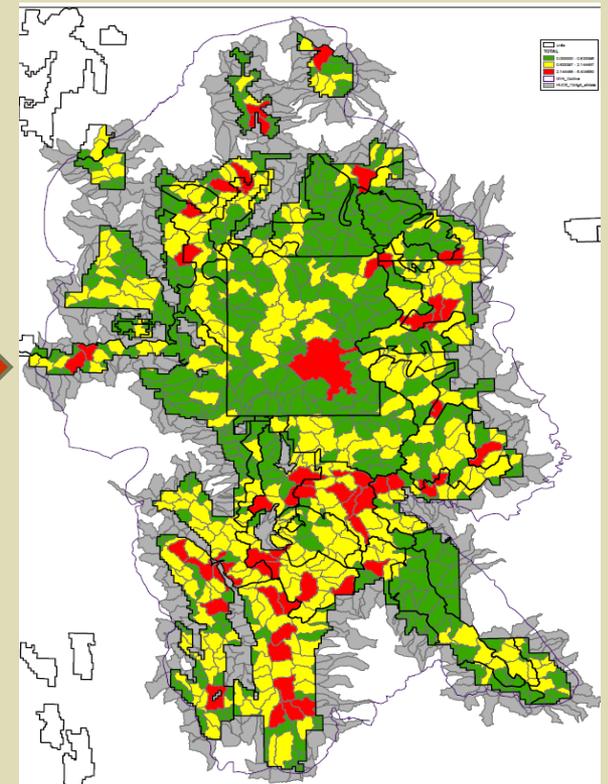
Roads/Trails

Green-low;
orange/yellow- medium;
red-high



**Developed
Recreation
Infrastructure**

Amount (sq. miles) of buffered road and trail crossings
or infrastructure located within stream buffers



**Combined Infrastructure
Value at Risk**

GYA WATERSHED VULNERABILITY ASSESSMENT

EXPOSURE

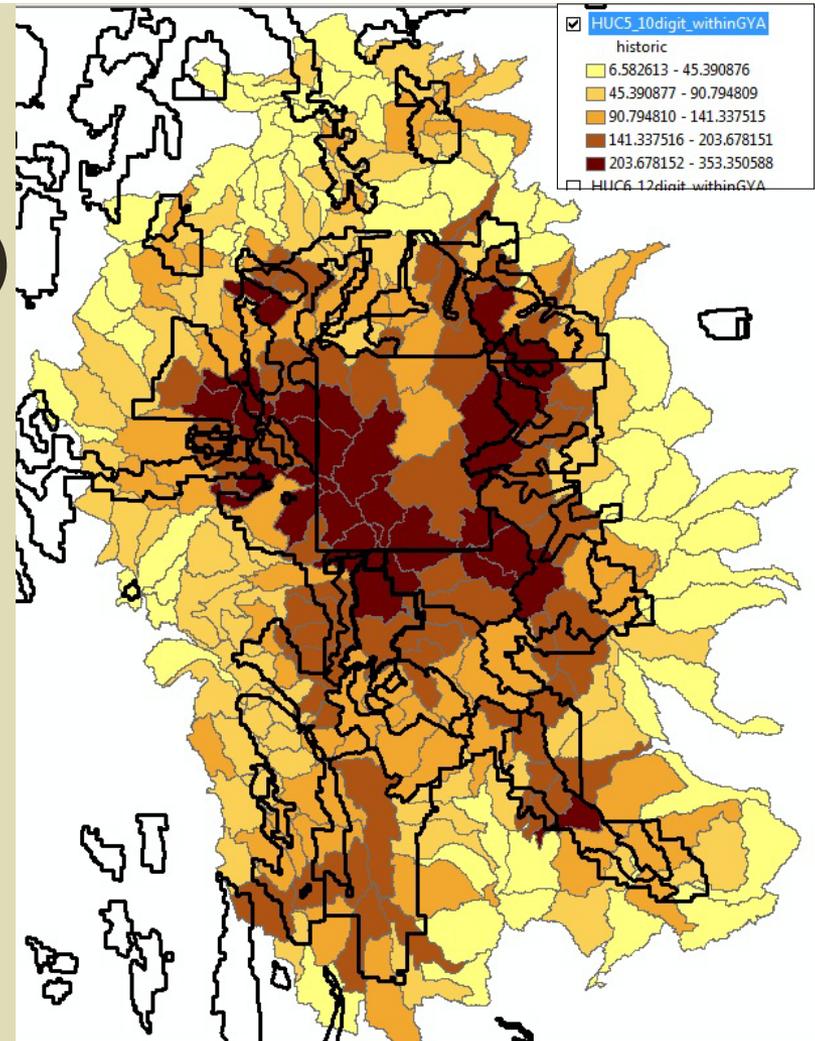
CLIMATE VARIABLE: COMBINED FLOW

Combined Flow

Historic Value (1915-2006)

Combined Flow =
Runoff plus Baseflow)
Spring (March-April-May)
seasonal total averages
(HUC5 level)

Darker = higher flow



GYA WATERSHED VULNERABILITY ASSESSMENT

EXPOSURE

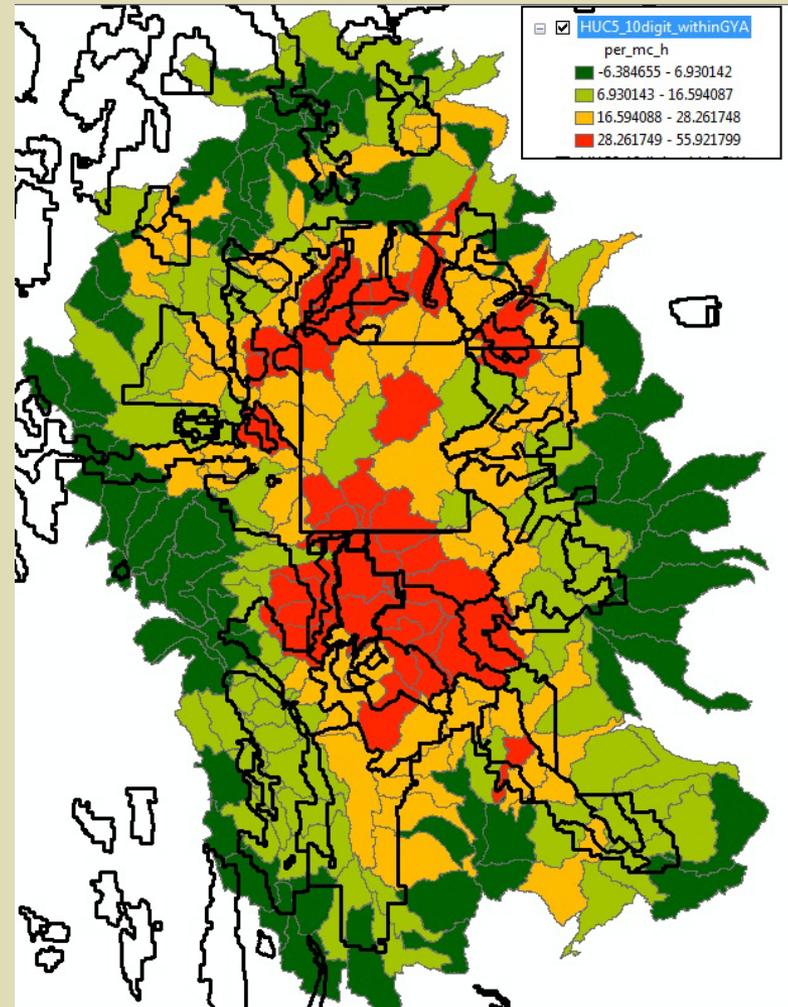
CLIMATE VARIABLE: COMBINED FLOW

Combined Flow

Percent Change to Mid-Century (2030-2050)

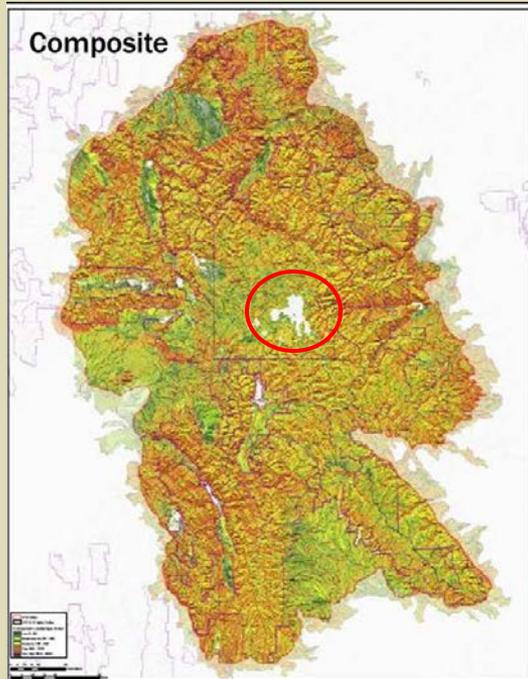
Lowest class (dark green) = either a decrease in combined flow from historic to mid-century or a very small increase.

Next three classes show increasing combined flow up to a 55.9% change (increase) between the historic and mid-century projections.

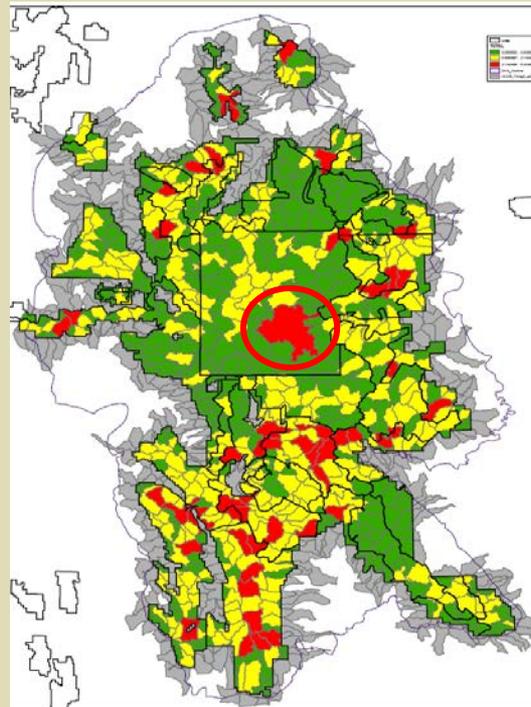


GYA WATERSHED VULNERABILITY ASSESSMENT

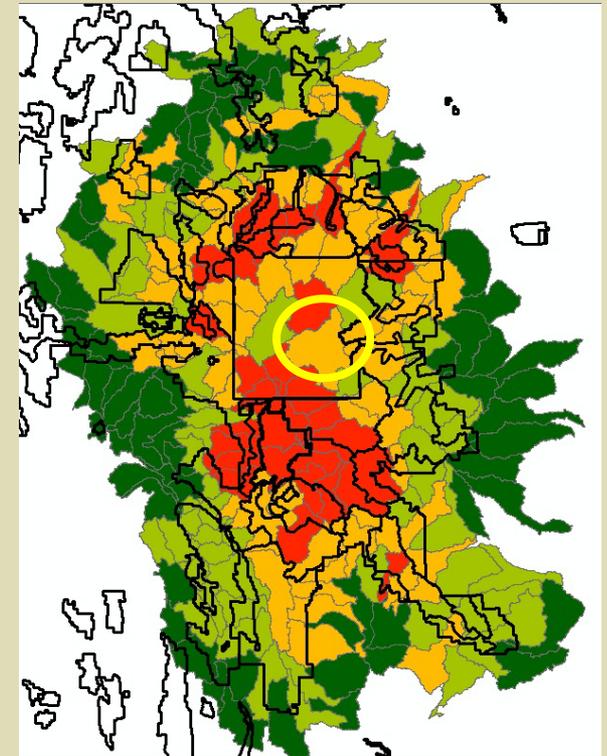
LET'S ADD IT UP: YELLOWSTONE LAKE



**Terrain
Sensitivity**



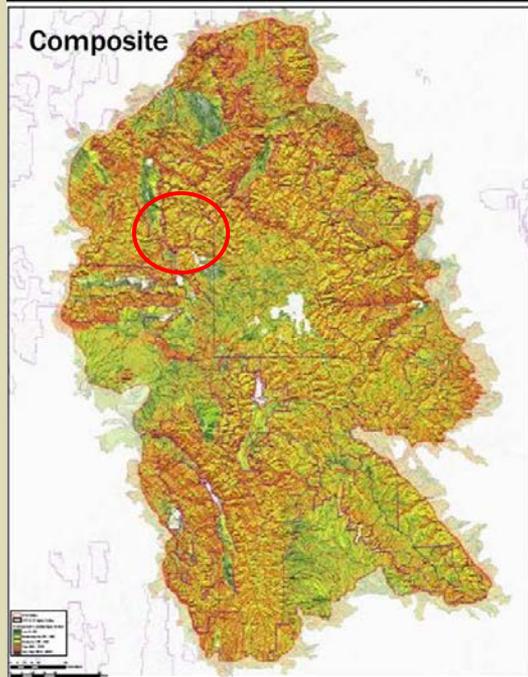
**Combined
Infrastructure Value
at Risk**



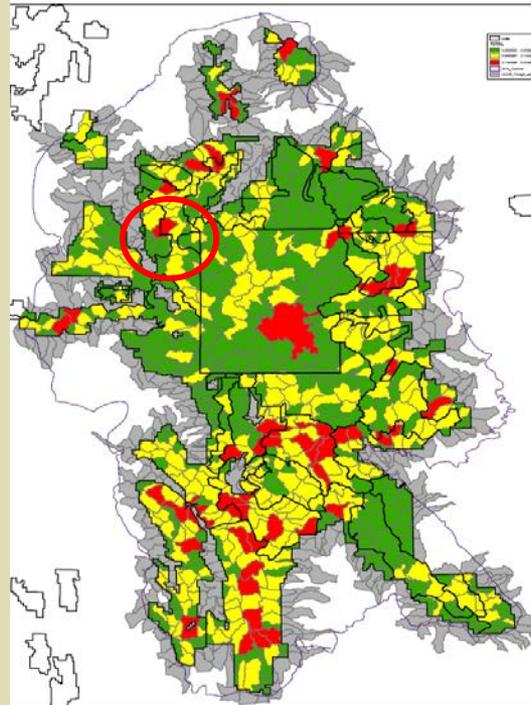
**Combined Flow
Percent Change to Mid-Century
(2030-2050)**

GYA WATERSHED VULNERABILITY ASSESSMENT

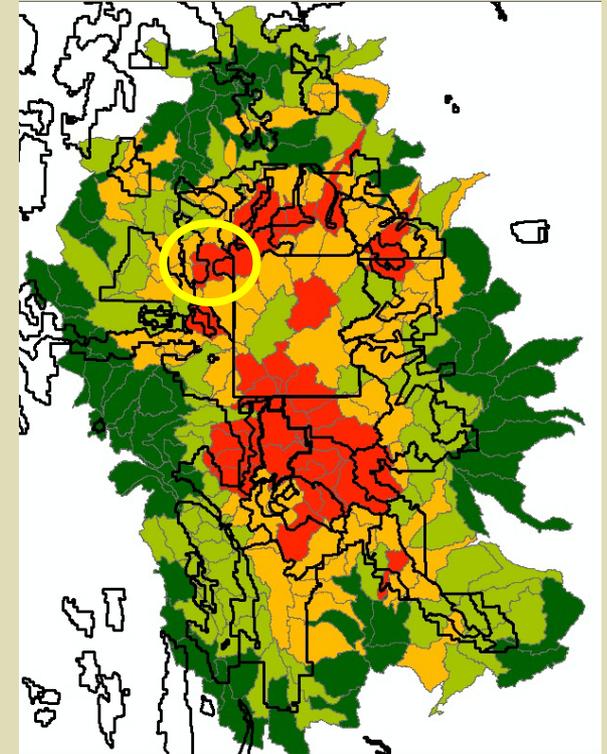
LET'S ADD IT UP: NATIONAL FOREST



**Terrain
Sensitivity**



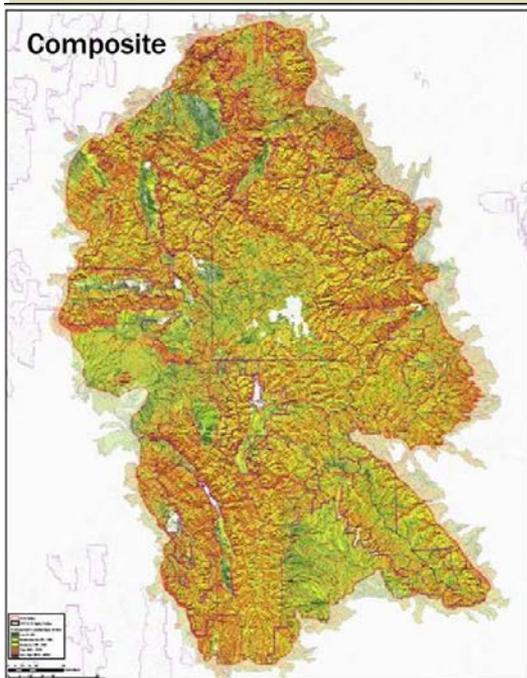
**Combined
Infrastructure Value
at Risk**



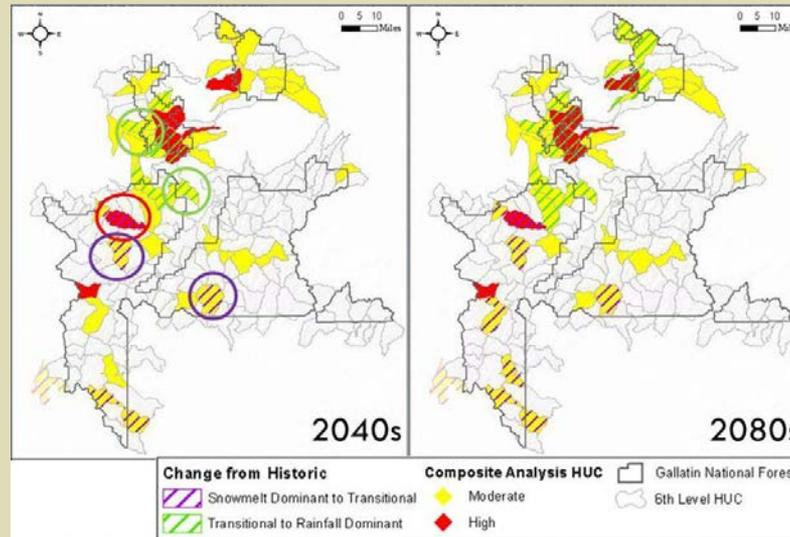
**Combined Flow
Percent Change to Mid-Century
(2030-2050)**

GYA WATERSHED VULNERABILITY ASSESSMENT

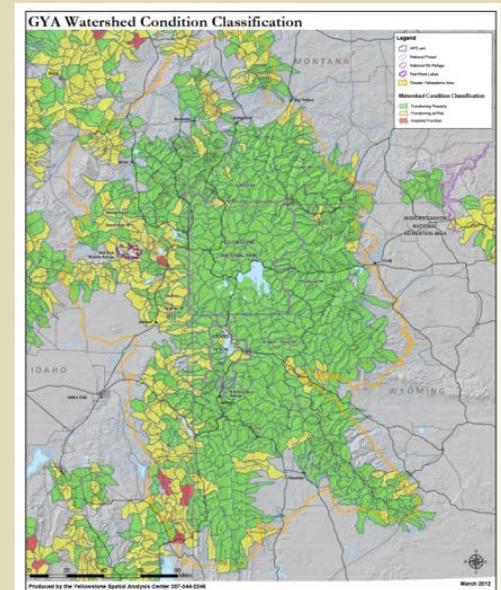
NEXT STEPS



1. Terrain Sensitivity
Create a similar watershed based map



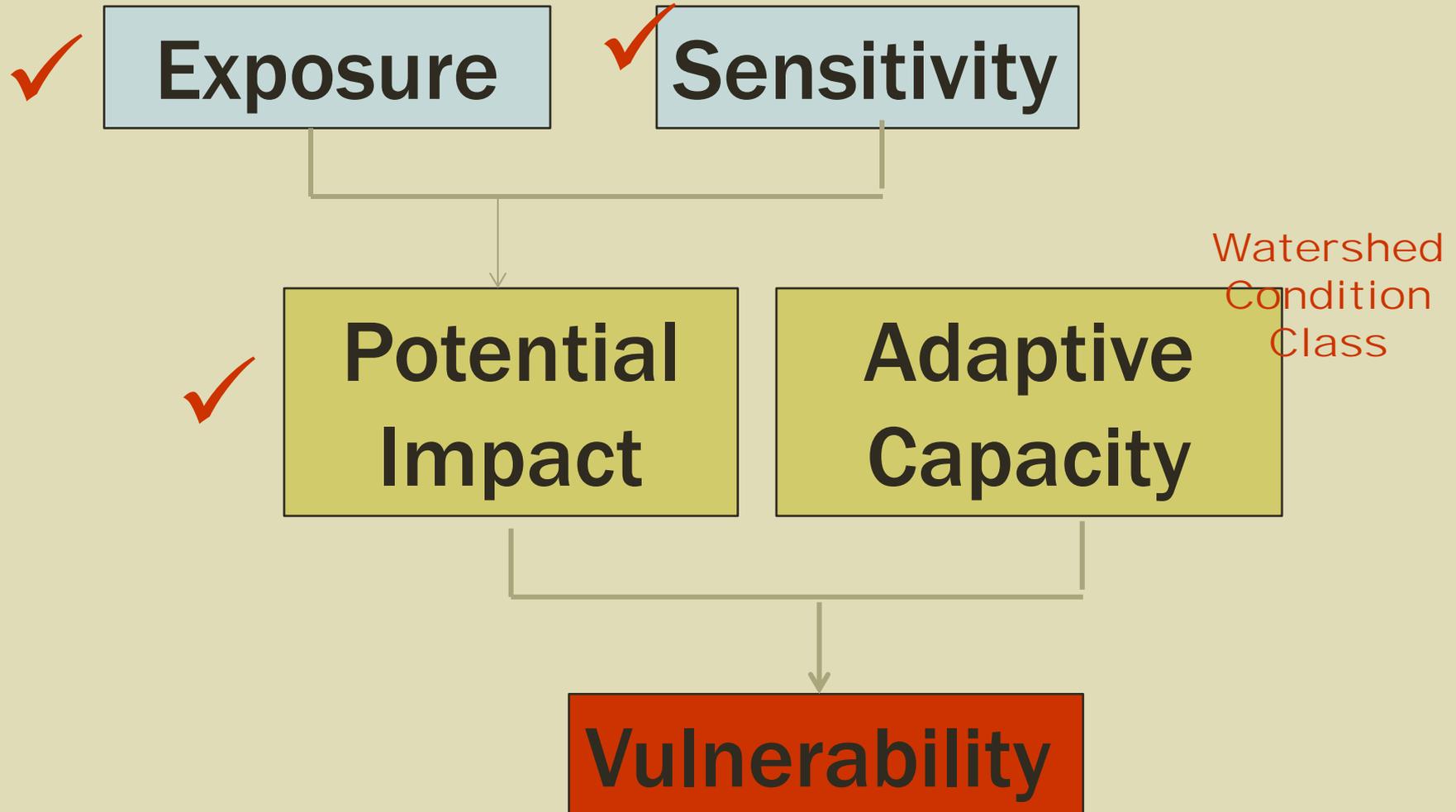
2. Create maps that combine Terrain Sensitivity, Values, Exposure
(Gallatin NF example)



3. Check results with Watershed Condition Class
(Adaptive Capacity?)

CLIMATE CHANGE ADAPTATION

SCANNING THE CONSERVATION HORIZON



GYA WATERSHED VULNERABILITY ASSESSMENT

CHALLENGES AND BENEFITS

Challenges

- Remote Team –accomplished by conference call
- Combining GIS Layers - different terminology by Agency
- Extra task on top of regular workload

Benefits

- Team members thought through a climate change application
- One staff per unit knowledgeable about project
- Informs day to day work; infrastructure, fisheries priorities
- Allows prioritization at each unit and GYA scale
- Can build upon effort: can add values, add exposures, etc.

GYA WATERSHED VULNERABILITY ASSESSMENT

THANKS TO THE TEAM!

- Louis Wasniewski –Team Leader. Caribou-Targhee NF
- Tom Keck – Terrain Model Leader. Gallatin NF
- Ann Rodman – GIS Leader. Yellowstone NP
- Allison Klein – GIS. Yellowstone NP
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- Eric Cole – National Elk Refuge

GYA WATERSHED VULNERABILITY ASSESSMENT

THANKS TO THE FUNDERS

Funders:

- US Forest Service Climate Change Office (Washington)
- Greater Yellowstone Coordinating Committee
- Each GYCC unit contributed staff time

Questions?