Forests, Water and Ecosystem Services

Experiences from the USA

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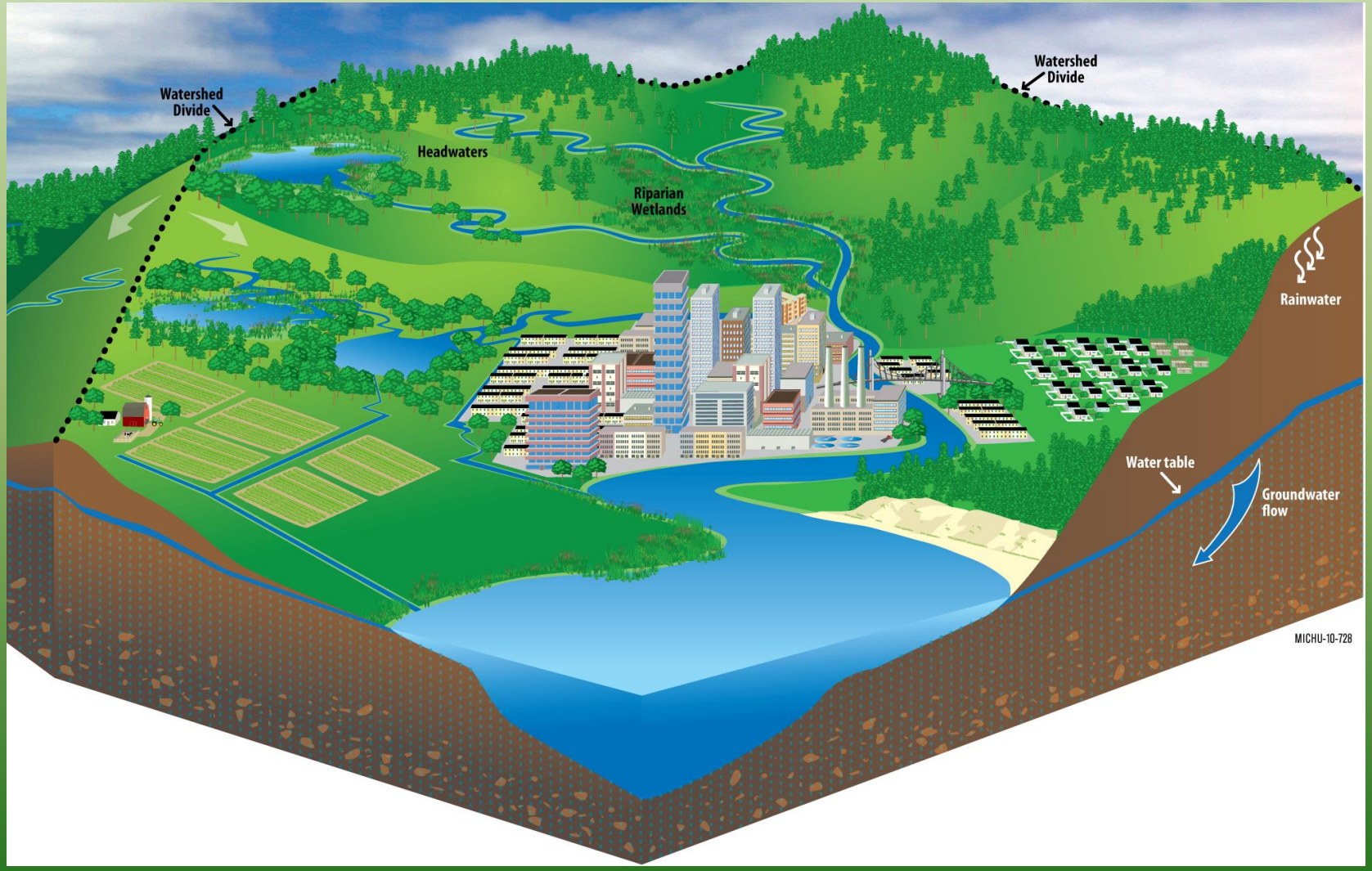
Objectives:

1. Describe some general concepts and issues relating water, forests and ecosystem services in the U.S. context

2. Provide several examples of strategies currently employed in the U.S. to enhance ecosystem services through the simultaneous management of forests and water

Watersheds as a unit of management and analysis



Credit: University of Michigan

Watershed Example

Portland OR Municipal Water Sources

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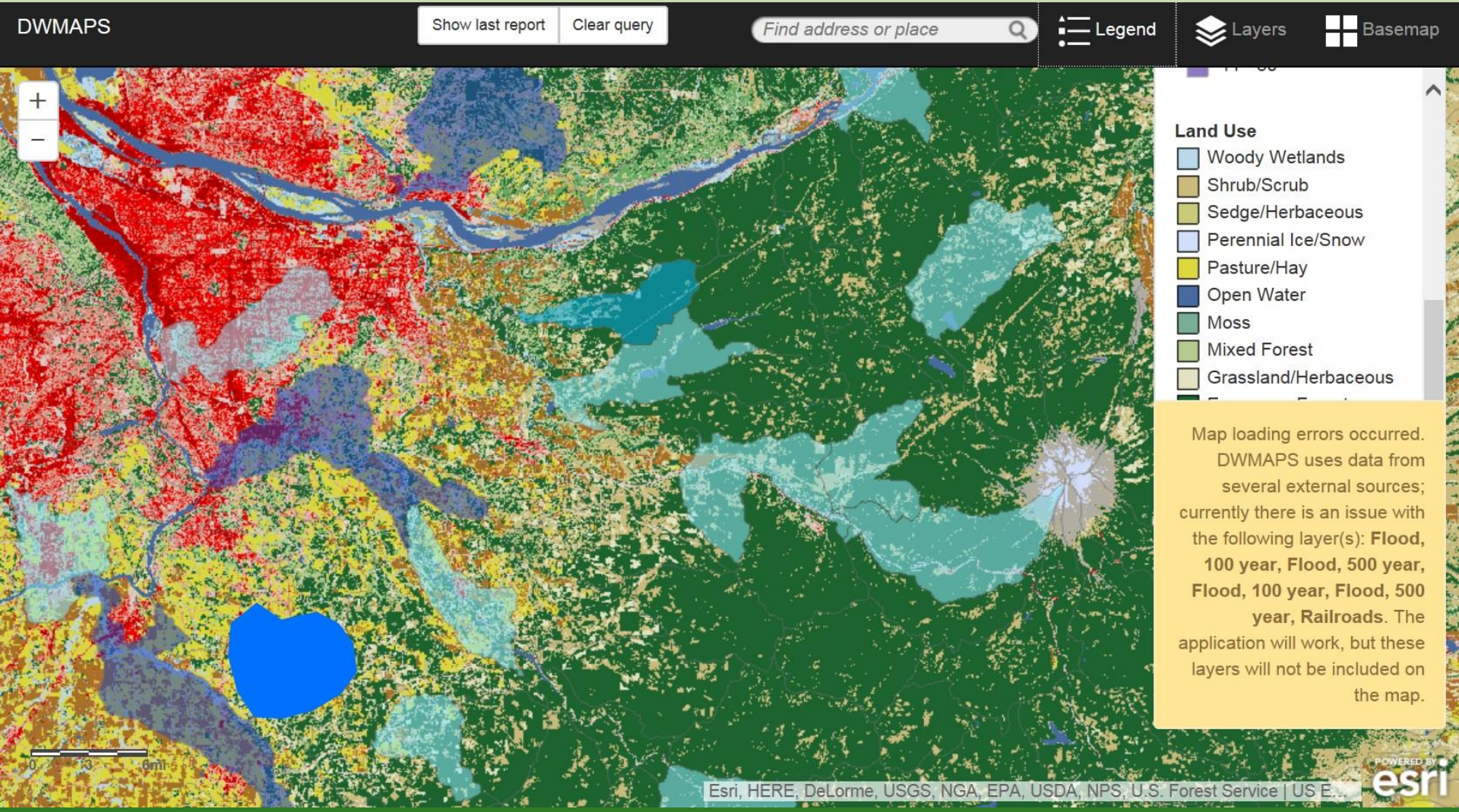


US Environmental Protection Agency (EPA) DWMAPS—https://epamap37.epa.gov/dwmaps/

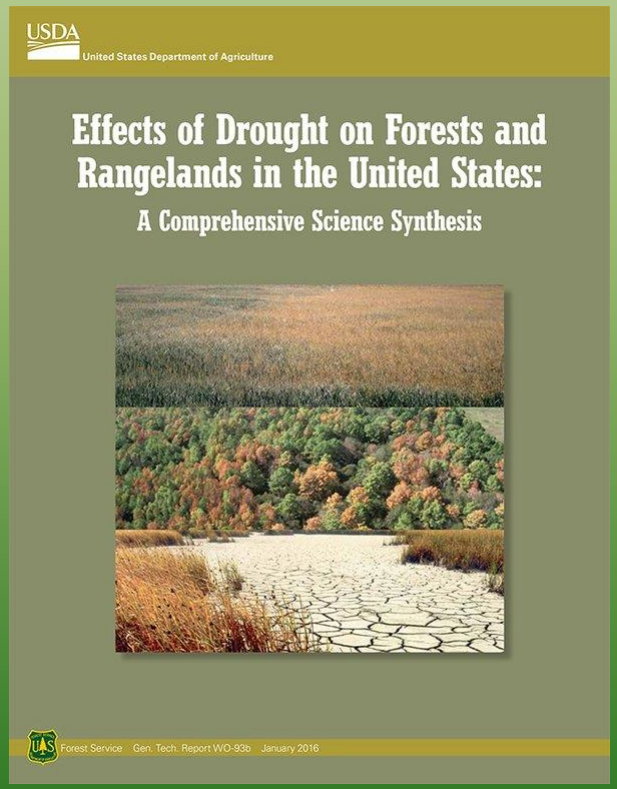
Forests and Water

Forests have a profound influence on water and watershed processes

- Water flow regulation
- Filtration and water purity/quality
- Stream temperature and habitat for aquatic species
- Erosion control and reduced sediment loads
- Transpiration reducing total water throughput
- Other

Water and Forests

Water similarly has a profound influence on forests and their biological processes



(US Forest Service, 2016)

Variable precipitation patterns and long-term trends associated with climate change are expected to influence forest conditions across the U.S., affecting tree mortality, disturbance activity (including fire), and tree species distribution.

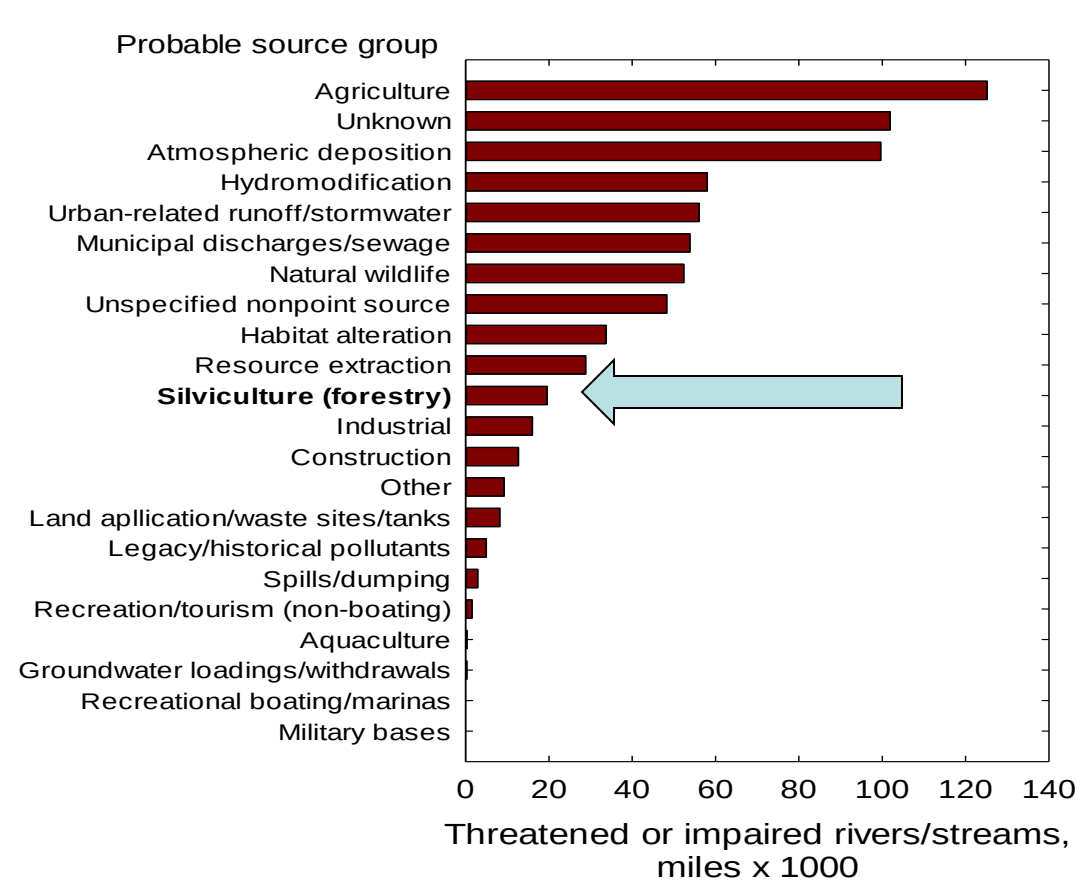
Drought is a particular concern in the West.

Major precipitation (floods) also an issue.

Forest management and water quality impairment

Forest management activities in the U.S. have traditionally been seen as having negative impacts on watersheds and water quality

But those impacts may actually be <u>relatively</u> small



MP Indicator 4.3.b: Miles of rivers and stream by probable source of impairment—based on US EPA survey (Amacher, 2015)

Forest management and watershed enhancement

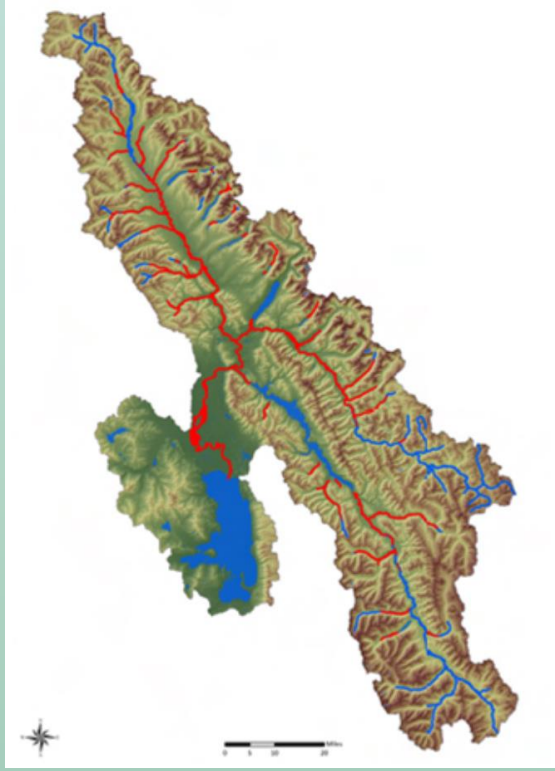
Emphasis is shifting in many places to using forest management proactively as a tool to enhance watershed conditions

- Afforestation and reforestation of watershed uplands
- Forest restoration activities
- Riparian buffers and related forest best management practices (BMPs)
- Other?

Some relevant ecosystem services

1. Species Habitat

E.g., bull trout (*Salvelinus confluentus*), an Endangered Species Act listed species threatened by rising stream temperatures



Model of critical bull trout habitats in the year 2059. Red indicates those reaches of stream that, without restoration efforts, are likely to be too warm to continue to serve as bull trout habitat in the future.

(L.A. Jones, 2012)

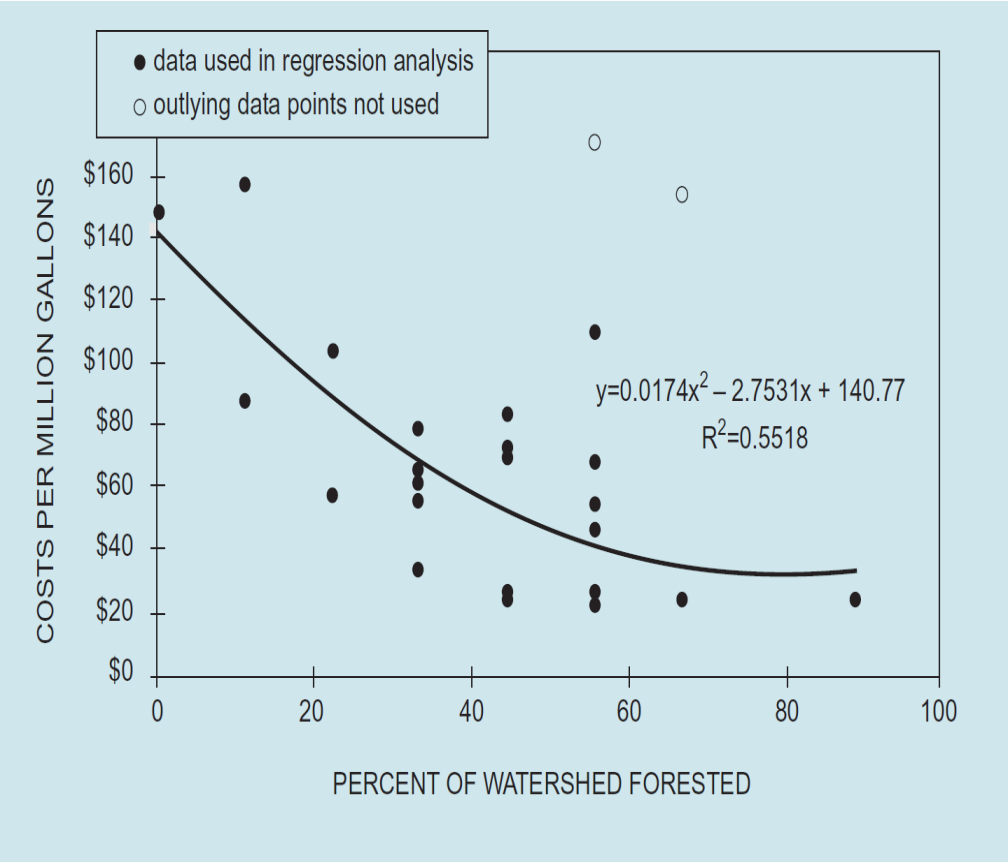
Some relevant ecosystem services

2. Water Quality

Recognized relationship between forests and water quality for drinking and other human uses

Over half of U.S. freshwater flows from forest lands

20% of U.S. population sources municipal water supply from Forest Service land at an estimated benefit of $7.2 billion a year

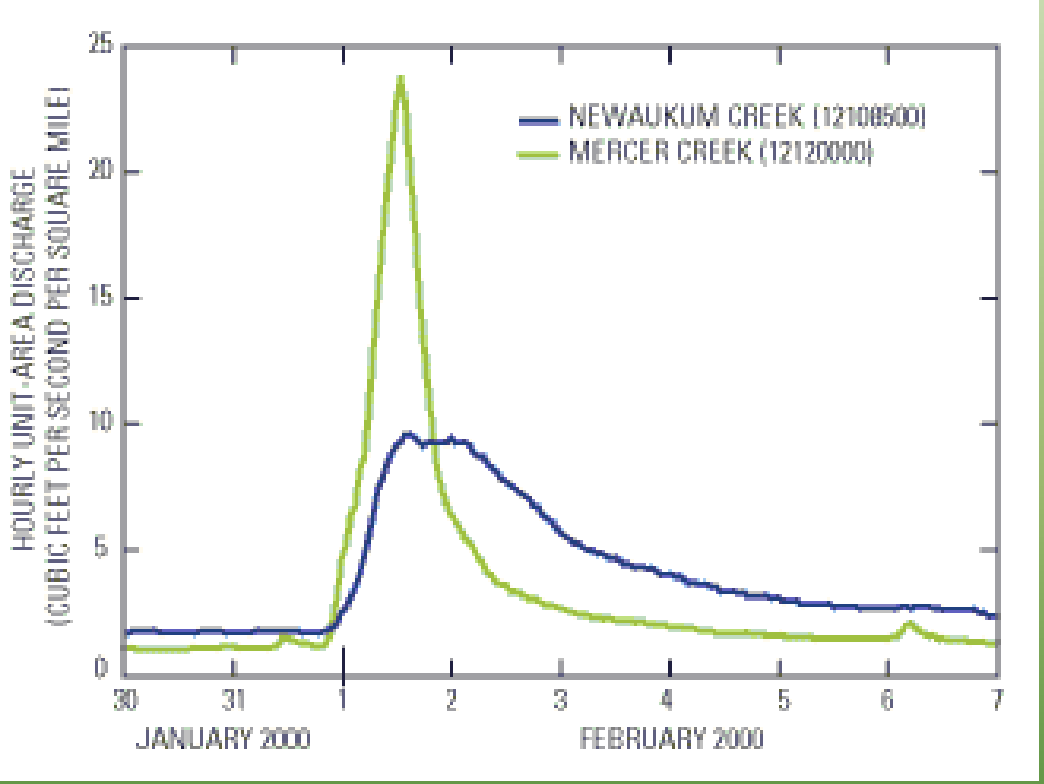


Estimated relationship between watershed forest cover and drinking water treatment cost (Source: Ernst 2004)

Some relevant ecosystem services

3. Flow regulation

Forests act to smooth out streamflow, particularly after major precipitation events



Storm discharge comparison between developed and forested stream in Washington State

(U.S. GEOLOGICAL SURVEY Fact Sheet 076-03)

Some relevant ecosystem services

4. Water based recreation (fishing, swimming, boating)

5. Hydropower

6. Scenery and Aesthetics

7. Trees and water as central components in many healthy ecosystems

8. Other special uses (e.g., grazing, industry, ski resorts)

Using forests to enhance water-related ecosystem services

Options include:

- Maintaining/enhancing forest cover in municipal watersheds
- Broadscale watershed restoration activities
- Urban and peri-urban forestry to mitigate storm runoff (“Green Infrastructure”)
- Improved engineering applications (e.g., stream channel and culvert design)
- Other?

Payments for Watershed Services as a tool

Options include:

- Watershed Investment Partnerships for landscape-scale restoration work
- Regional coordination to make strategic investments in road-stream crossings (upgrade, remove, replace)
- Secure private in-holdings of source water via easement or fee acquisition
- Investments of public $ explicitly focused on water and forestry

Example 1. Flagstaff Watershed Protection Project: *The Economics of Wildfire*

Estimated total impact of the Schultz Fire = **$133 million - $147 million**

- Suppression costs and loss of property values were major cost drivers

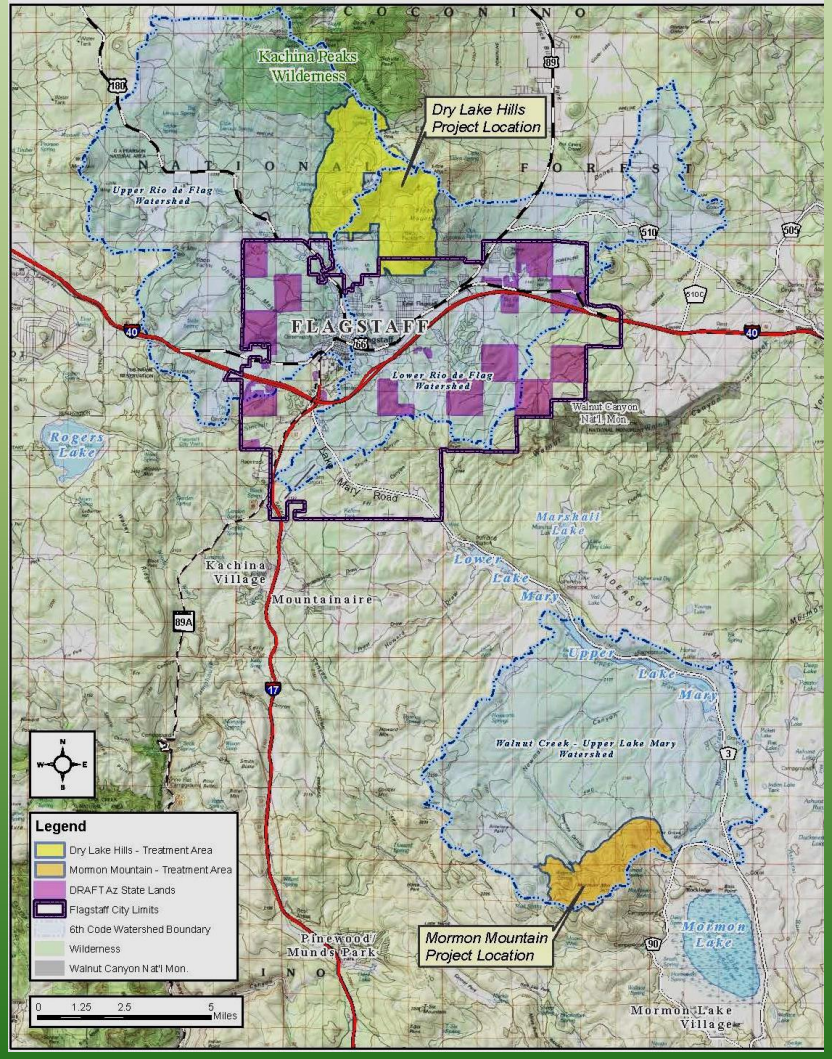
Avoiding the cost of future fires and protecting bundled ecosystem services (water included) was the motivation for project

Cost savings of $573 million to $1.2 billion estimated for the project

Example 1. Flagstaff Watershed Protection Project: *The Partnership*

Flagstaff voted overwhelmingly for a $10 million municipal bond that would fund fuel hazard treatment projects on NFS land spanning 50% of the city's water supply

Funding is now being leveraged throughout the state for similar restoration projects, and regional cooperatives include public utilities, philanthropists, city governments, and tribal representatives. Hydroelectric and water utilities figure prominently.



10,544 total USFS acres

Example 2. Investing in improved water engineering applications on federal (Forest Service) Lands

- In Vermont, Hurricane Irene (2011) resulted in 1,477 road-stream crossing failures ($6.4 million in repairs on 40 km of FS roads)
- Upgrades in stream simulation design provide multiple benefits

Example 2. Investing in improved water engineering applications on federal (Forest Service) Lands

The Salmon Super Highway Project:

- The county, local environmental coalitions, the dairy farmers, Trout Unlimited, two watershed councils, Oregon state agencies, US FWS, BLM, NRCS & USFS combined to invest $34 million in 93 cost-effective projects to maximize downstream benefits

A Broader Coalition

The portfolio of partners and stakeholders engaging with the Forest Service around water is expanding

NORTHERN ARIZONA FOREST FUND

McKenzie Watershed Council

Santa Fe WATERSHED ASSOCIATION

1965 - 2015 WESTERN STATES WATER COUNCIL

The Nature Conservancy
Protecting nature. Preserving life.™

Coca-Cola

Summary

- The positive contributions of forests and forest management for water are increasingly recognized
- The economic dimensions of this relationship are becoming clearer, providing added motivation for diverse partnerships
- Payments for water-related services provide an excellent opportunity for PES schemes, explicitly linking forests and downstream beneficiaries in the provision of valued ecosystem services

Thank you…