# Tamarisk Mapping in the West and the Importance of Coalition-Building

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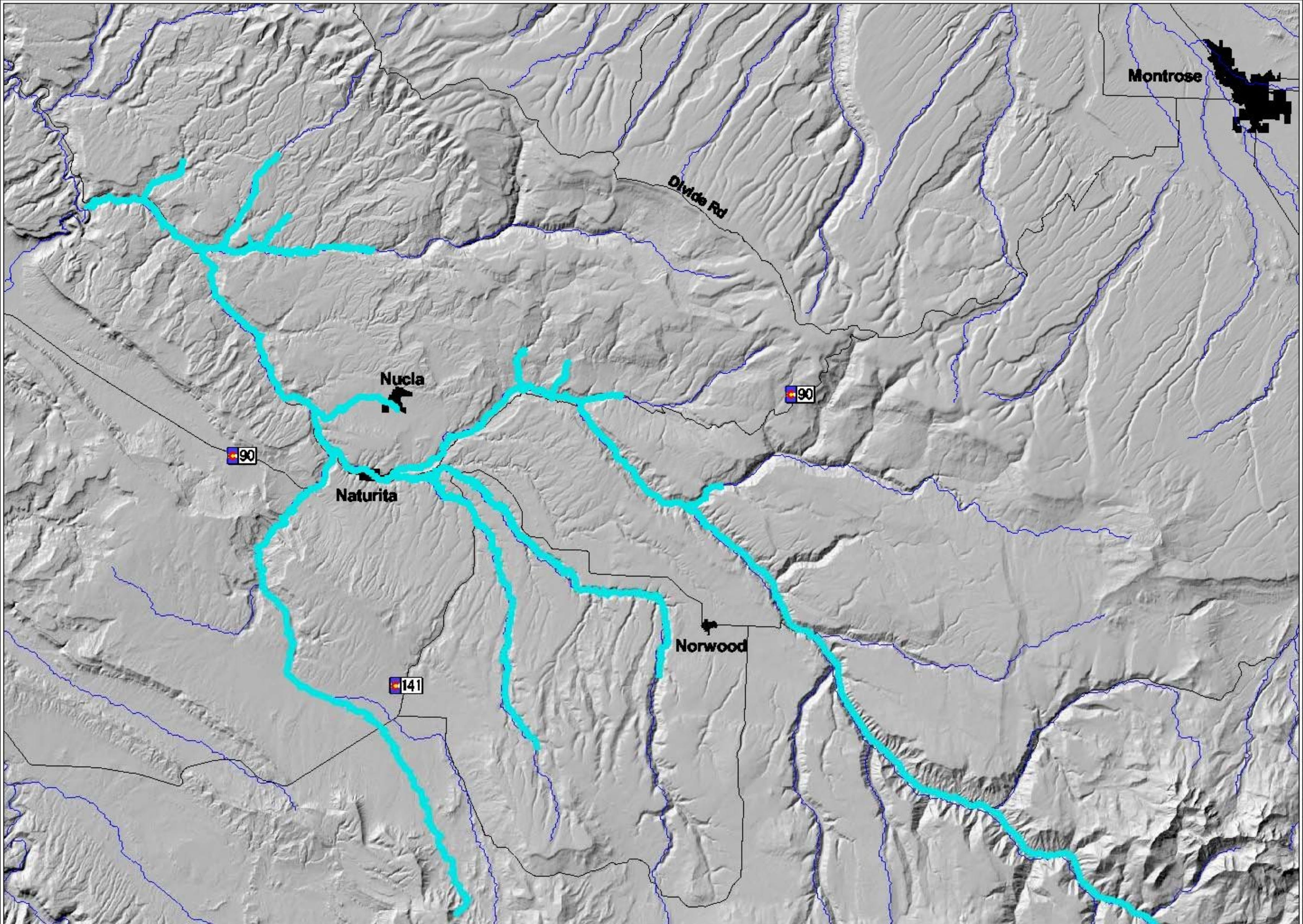
State of Colorado

# Overview

- Survey of tamarisk mapping efforts, highlighting a few of particular interest
- Can mapping facilitate:
  - a more thorough understanding of the problem,
  - a process through which diverse interests can envision a common solution, and
  - coalition-building to implement a resolution to the problem?

# Tamarisk mapping efforts of note

1) The Nature Conservancy - San Miguel River Basin
    - Mapping in service of management for 1,000,000 acre watershed in SW CO
        - Management goal: prevent tamarisk from negatively impacting watershed
        - Mapping goal: catalog extent of infestation and facilitate adequate approximation and efficient allocation of resources




# Saving the Natives Project Area

The Nature Conservancy
Saving the Last Great Places

Tamarisk Project Area
Hydrography
Transportation
Towns

N
1:375000

Project Area

- Mapping based on visual identification and distribution/density approximation
- Each drainage divided into $^{1}/_{10}$ mile segments, inspected in the field, and assigned a density class
- Air (68%) and ground (32%) survey
- Data compiled in ArcView

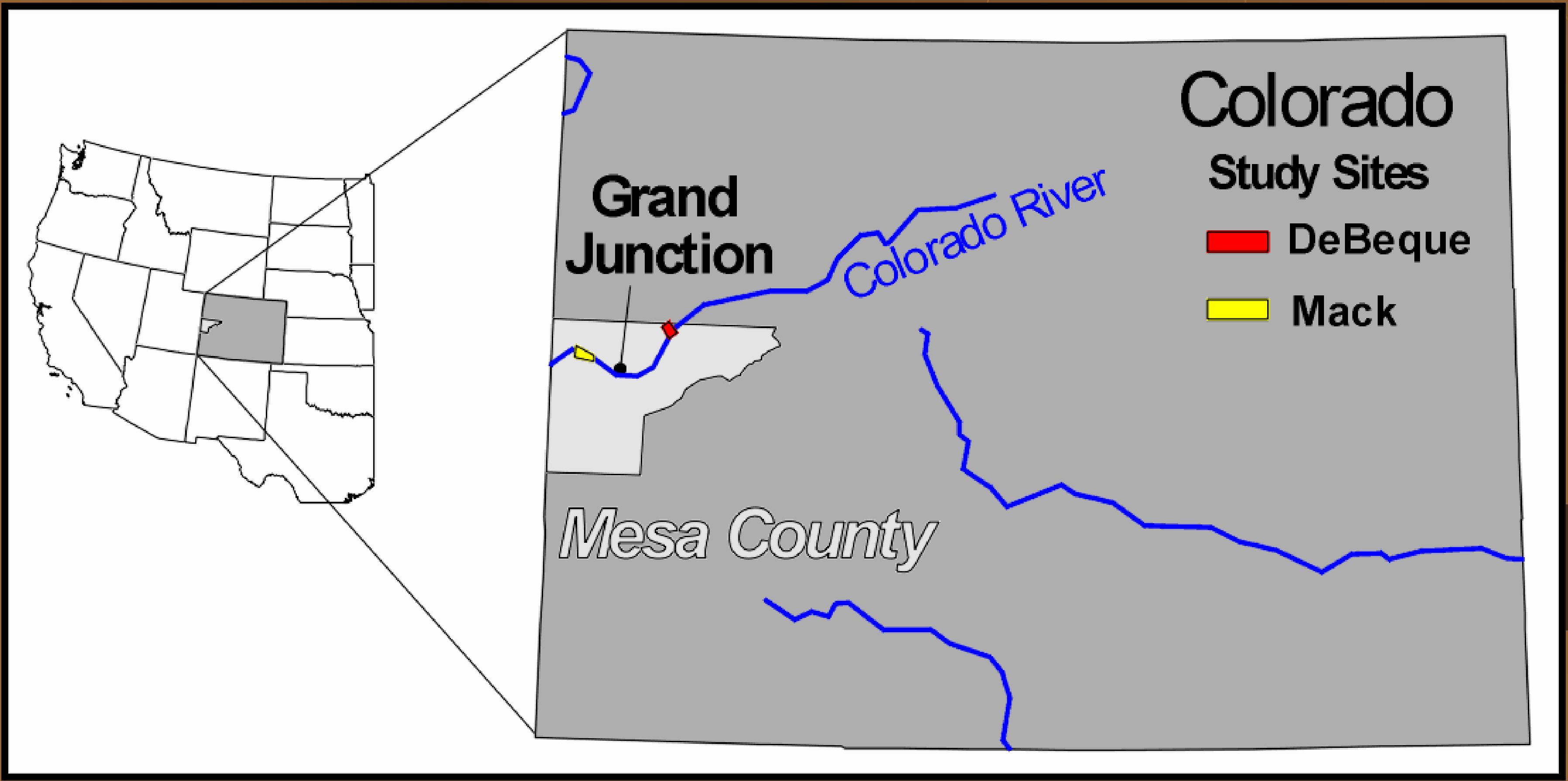
- Results:
  - 40.6 miles of the San Miguel River surveyed
  - 112 miles of 12 tributaries surveyed
  - Tamarisk detected in 62% of all segments
  - Informed management effort that has efficiently allocated resources toward watershed-wide tamarisk eradication

2) Collaborative effort to evaluate the effectiveness of remote sensing

- Colorado Big Country RC&D (Glenwood Springs)
- Tamarisk Coalition (Grand Junction)
- USDA Forest Service Remote Sensing Application Center (Salt Lake City)

- Study evaluates:
  - Remotely sensed imagery of varying spatial, spectral and temporal resolution for its applicability to map tamarisk
  - Reliability and applicability for inventorying tamarisk using each method or combination of methods
  - Cost of utilizing different data sources

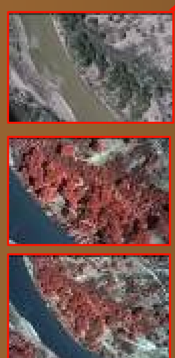
# Study site locations



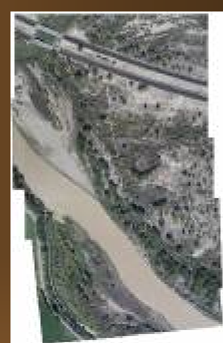
# Data from Mack study site (similar for DeBeque site)

4 m
hyperspectral
data (126 bands)
July 2002

Field visit site



< 0.3 m
06/'02
CIR & NC
Digital camera



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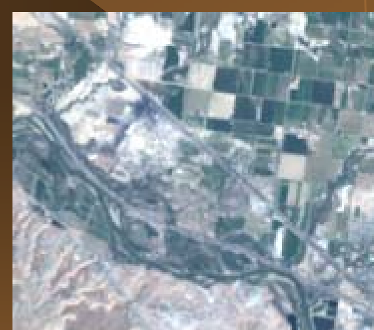


30 m
07/'02
Landsat ETM+

0.5 m
1997
Aerial photography

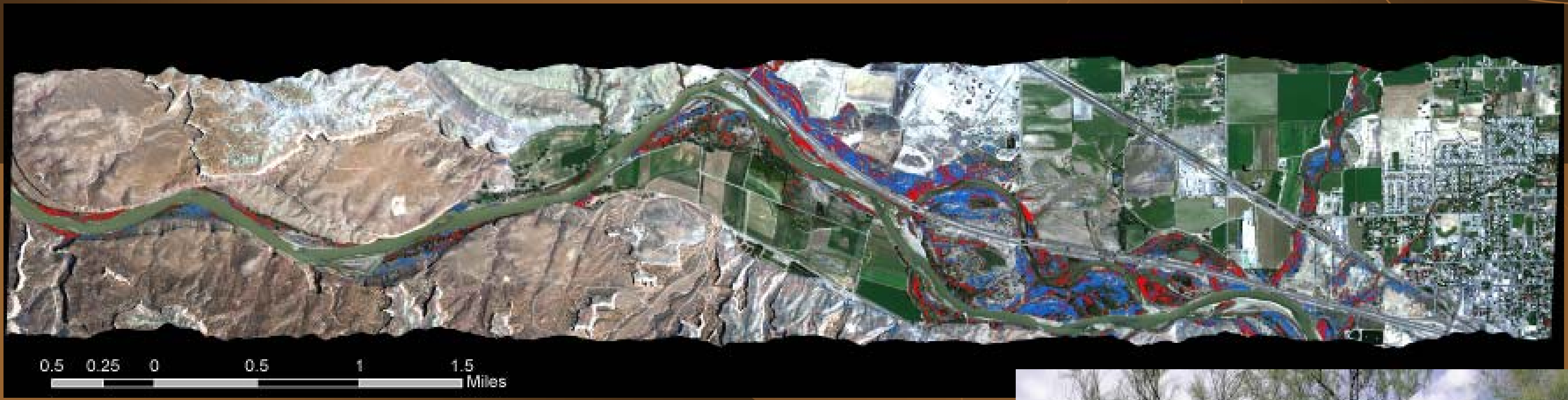
- Digital imagery collected and assessed includes:
  - Color (0.3m), color infra-red (0.3m), and hyperspectral (4m -126 bands) aircraft platform
  - Ikonos-2 (4m - 4 bands VIS/NIR)
    Landsat 7 (30m -7 bands VIS-FIR)
    Aster (15-30m - 9 bands VIS-SWIR)

- Results:
  - Landsat and Aster imagery too coarse (15-30m/7-9 bands) for effective evaluation
  - Ikonos yields reasonable imagery that can lead to successful identification of tamarisk

- Results:
  - Color IR can be evaluated successfully but it is difficult to separate out other species such as greasewood
    - However, Russian-olive was easy to detect, perhaps because imagery gathering coincided with flowering
    - Analysis incorporated spectra and texture

- Results:
  - Hyperspectral data analysis most successful
    - Field-based accuracy assessment yielded overall accuracies of 76% and 89%
    - Russian-olives and cottonwoods were easy to distinguish

# Mack Hyperspectral Classification




Vigorous tamarisk

Senesced tamarisk

Senesced

Vigorous

# Boeing Applications Mapping Tamarisk – Radiance vs. Reflectance – DeBeque site

Radiance results

Reflectance results

Detections highlighted in red

# Mapping Tamarisk - Results

## Ground Truth Results

- Boeing results:
  - Extremely good accuracy - no false positives
- Boeing future:
  - Evaluating AVIRIS (20m - 224 bands VIS/IR) aircraft platform
  - Highly suggestive - promising

3) Western Weed Coordinating Committee regional mapping effort

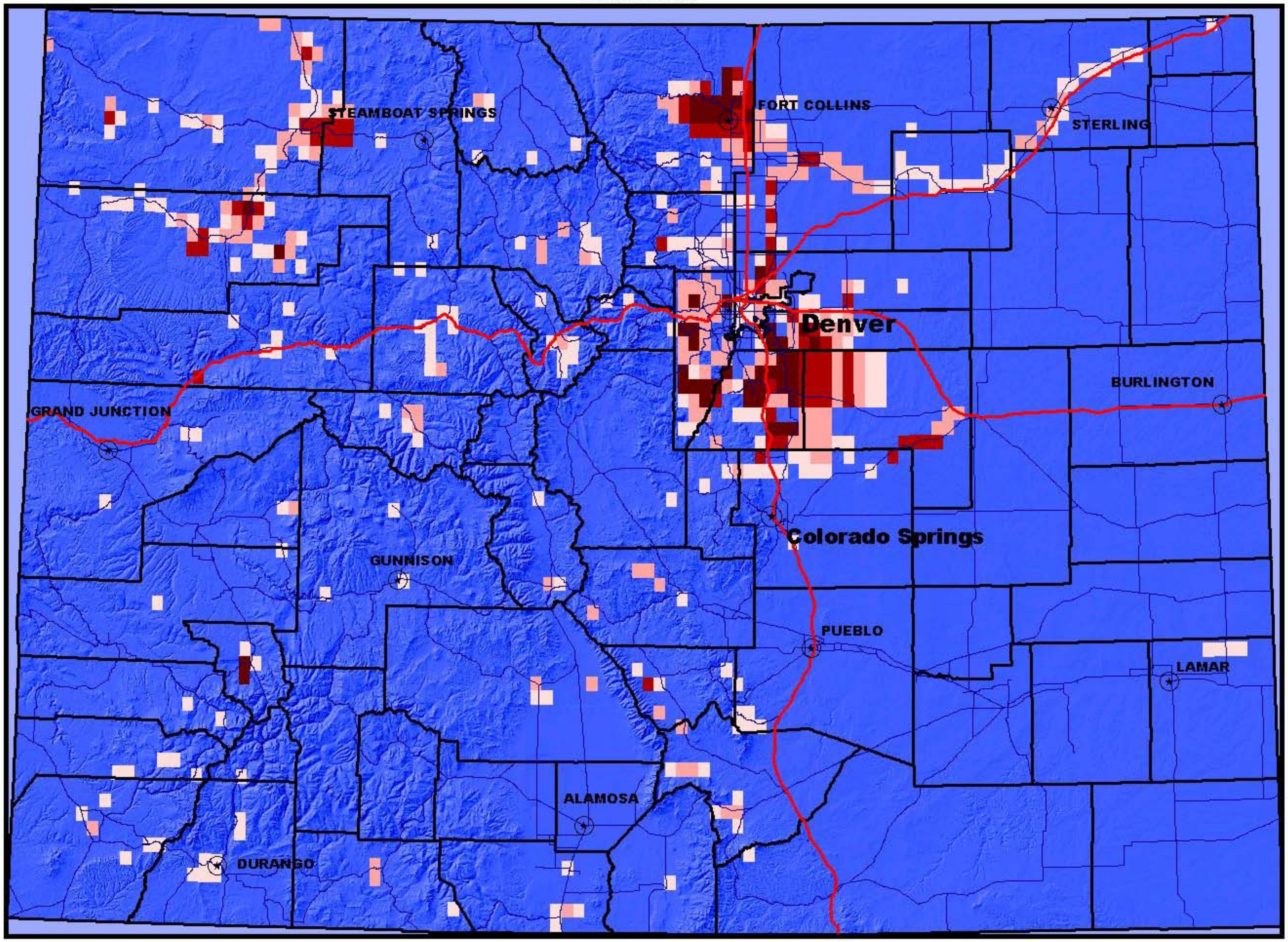
- Objective: Inform western weed managers of the scope of the tamarisk problem so a solution can be devised
- Mapping goal: Determine distribution and abundance of tamarisk across 17 western states

- Methods:
  - Solicit data from each county regarding the location and infested acreage of tamarisk utilizing quarterquad grid system – best available information from local weed managers
  - Assemble data in GIS

# Leafy spurge

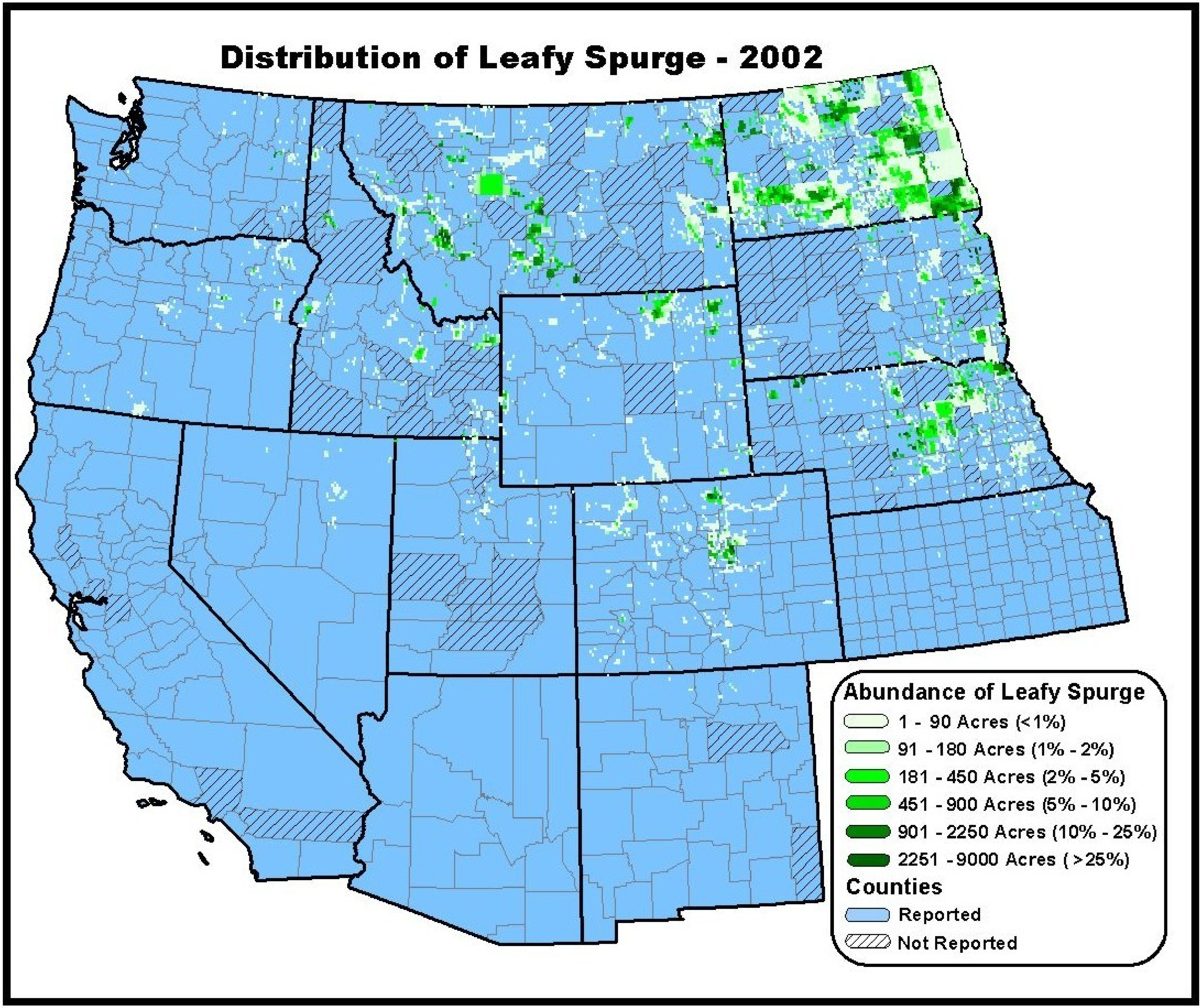
2002 Quarterquad Survey
Distribution and Abundance
in Colorado

**73,827+ infested acres**




**Distribution Legend:** 0 acres/ 9000 acre quarterquad | 1 - 5 acres | 6 - 50 acres | 51- 300 acres | 301 - 5000 acres

Acreage estimates supplied by County Weed Supervisors and compiled by Colorado Department of Agriculture and Colorado State University



Distribution of Leafy Spurge - 2002
Abundance of Leafy Spurge
1 - 90 Acres (<1%)
91 - 180 Acres (1% - 2%)
181 - 450 Acres (2% - 5%)
451 - 900 Acres (5% - 10%)
901 - 2250 Acres (10% - 25%)
2251 - 9000 Acres ( >25%)
Counties
Reported
Not Reported

# Where Does Mapping Lead?

- Mapping helps define the problem
- Maps can present a common frame of reference with which diverse interests can envision common solutions
  - Example – leafy spurge

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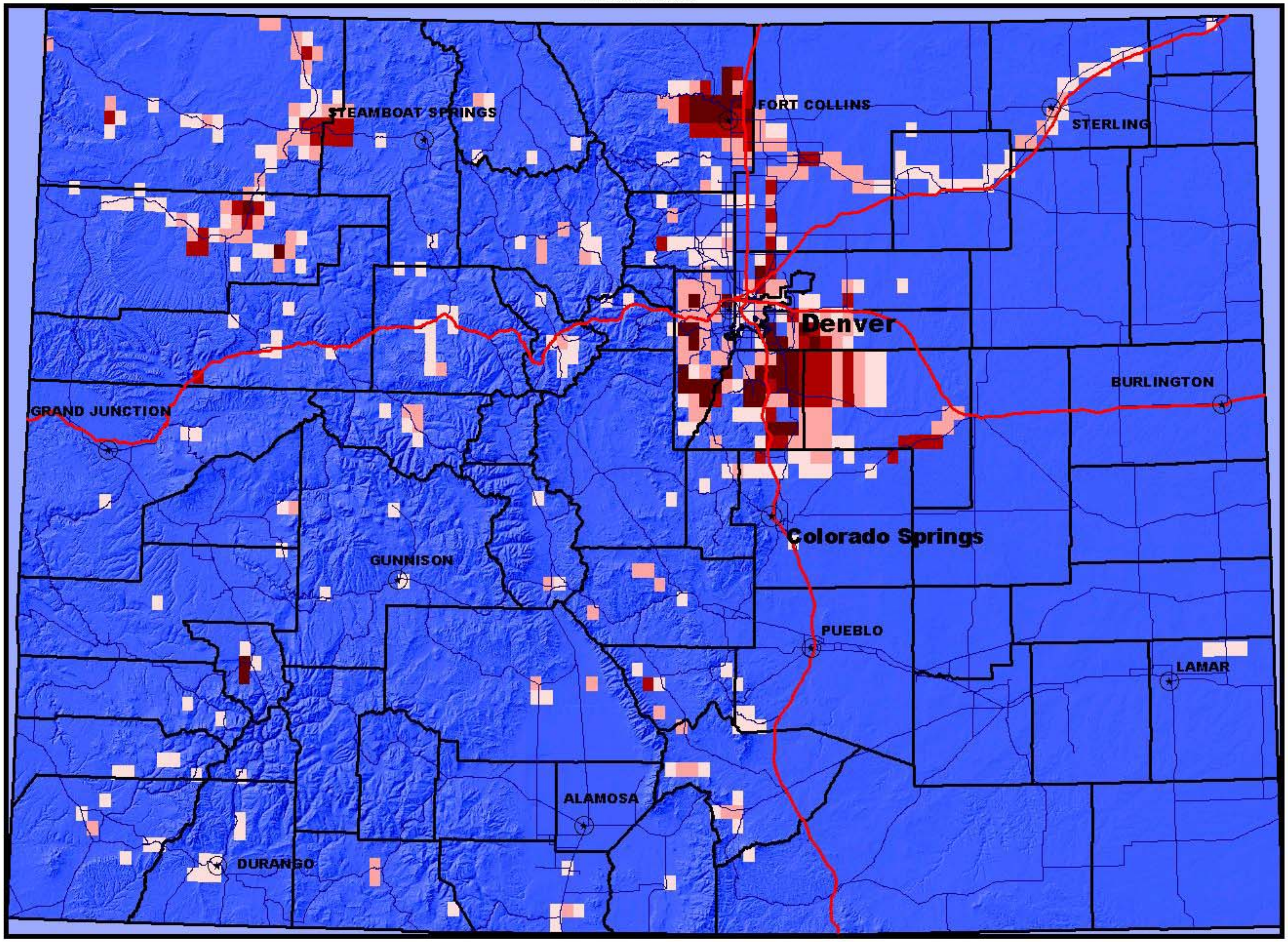


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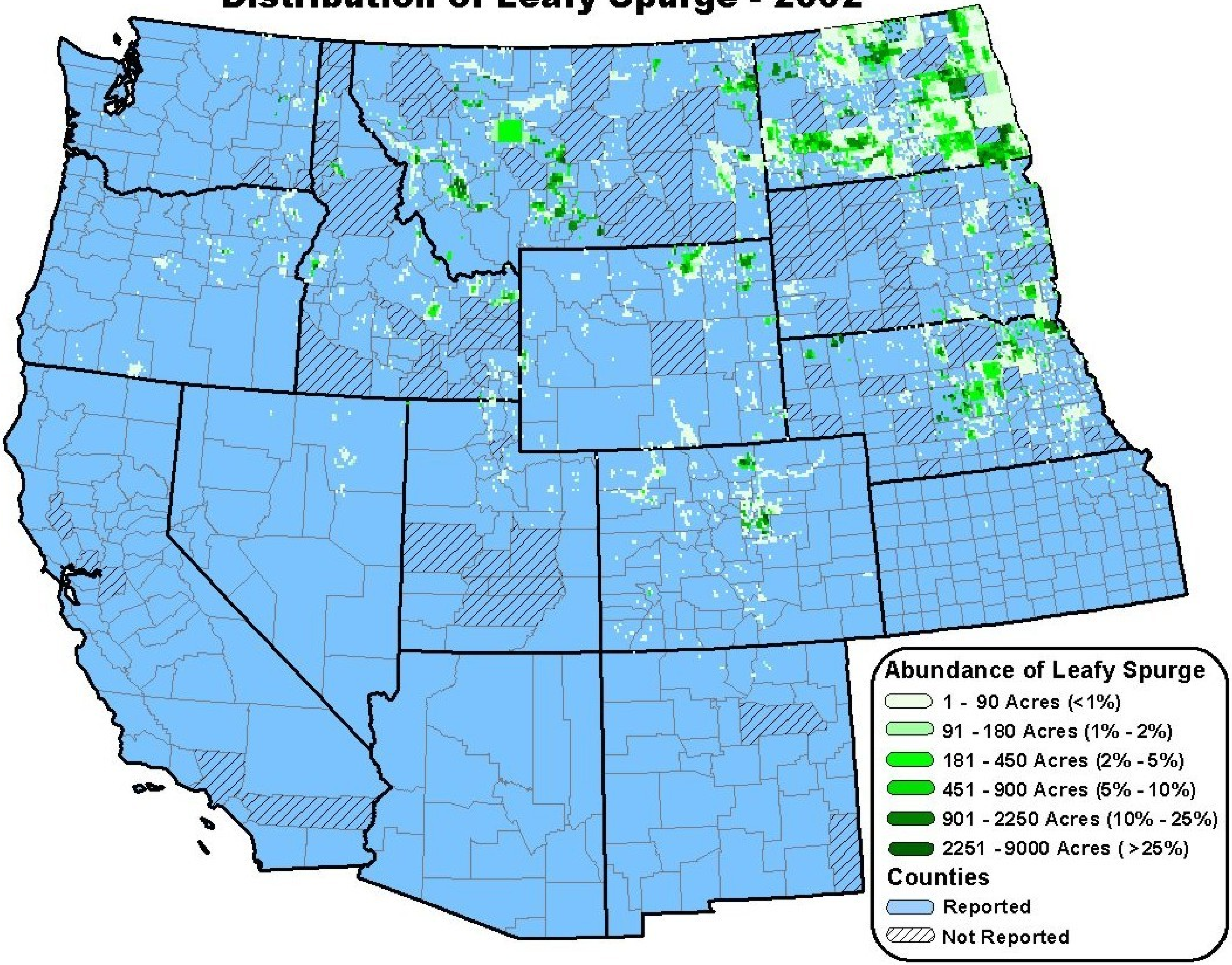

- Can diverse interests coalesce to craft and implement a collective solution?
  - Weed Management Areas locally
  - Weed Management Areas regionally
    - Greater Yellowstone Area
    - Upper Arkansas Regional Weed Management Coop
    - Middle Colorado River Watershed CWMA
    - Tri-State Demonstration WMA

- To achieve common, statewide priorities for weed management and facilitate more cost-effective management efforts, a number of states have set species specific goals for all jurisdictions within their boundaries:
  - CA – statewide eradication for all rare noxious weed species (46 species)
  - WA – statewide, coordinated efforts to stop the spread of specific species (65 species)

- Many of the most successful coordinated weed management efforts have adopted the principles of Dr. Dewey’s wildfire paradigm as a core framework for action:
  - Prevention of introduction
  - Early detection/rapid response (eradication)
  - Management of established populations (containment and suppression)
  - Revegetation and restoration as desirable

- This method for prioritizing management actions has been applied at all levels (local, large watershed, and state) for which coordinated efforts have been initiated
- It provides a straightforward framework which can be embellished with additional concepts and considerations to better reflect specific conditions or limitations

- For regional coordination and prioritization of efforts to be successful:
  - Many jurisdictions must be willing and able to agree to a common framework for setting and acting upon priorities
  - Additional considerations may be essential in order to implement and sustain regional collaborative efforts

- Prevention as well as early detection/rapid response must be adopted universally where applicable for specific species
  - Financial resources and assistance must be dedicated to assisting all local jurisdictions in attaining this capability
- Vectors and direction of spread must be well understood in order to achieve early detection as well as containment

- Values that have been impacted or are threatened (agricultural productivity, biodiversity and other environmental values, recreational and cultural resources) must be enhanced and protected to the extent practicable
- The influence of pork-barrel politics must be recognized and accommodated, but mitigated to the extent practicable

# Concluding remarks

- To protect our own individual, jurisdictional interests, it will be necessary to collaborate with others in surrounding jurisdictions
- Fortunately, the framework to manage species successfully across a broad, multi-jurisdictional landscape exists for adoption

- However, to collaborate successfully on the broader landscape, there are costs. Managers at all levels will have to:
  - Yield some authority
  - Redirect some resources
  - Share new resources equitably

# Thanks to:

- Mallory Dimmit, The Nature Conservancy
- Denise Laes (USFS Remote Sensing)
- Bill Penn (Boeing)
- Center for Invasive Plant Management
- Western State Weed Coordinators