

## National Resources Inventory Rangeland Resource Assessment

### Native Invasive Woody Species

October 2010

#### About the Data

Estimates presented here are based upon rangeland data collected on-site as part of the National Resources Inventory (NRI).

Rangeland is defined by the NRI as a *Land cover/use* category on which the climax or potential plant cover is composed principally of native grasses, grass-like plants, forbs, or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland.

This includes areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some

The National Resources Inventory (NRI) is a statistical survey of natural resource conditions and trends on non-Federal land in the United States. Non-Federal land includes privately owned lands, tribal and trust lands, and lands controlled by state and local governments.

The NRI rangeland results presented here address current conditions. In the future, the NRI rangeland survey sample will include revisited sites. This will allow estimates for change in rangeland resource conditions to be made.

The NRI findings presented here provide information about native invasive woody plant species growing on non-Federal rangeland. Some native woody shrubs such as juniper and mesquite can invade areas replacing native grasses and forbs. Dense stands can alter nutrient and energy cycles, affect hydrology, and reduce wildlife habitat and forage for domestic animals and wildlife. Deep root systems of woody species such as mesquite can reduce water availability to both plants and animals. The native invasive woody species groups in this report include:

- Eastern redcedar
- Juniper species including eastern redcedar
- Juniper species excluding eastern redcedar
- Mesquite

(Please see Table 1 for the list of species in each group.)

#### Key Findings

- Invasive juniper species are widespread, but especially prevalent in the Great Plains from the Canadian border to the

deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland.

These results are based upon NRI rangeland data collected in the field on rangeland during the period 2003 to 2006. Current estimates cover non-Federal rangeland in 17 western states (extending from North Dakota south to Texas and west) and to a limited extent in Florida and Louisiana.

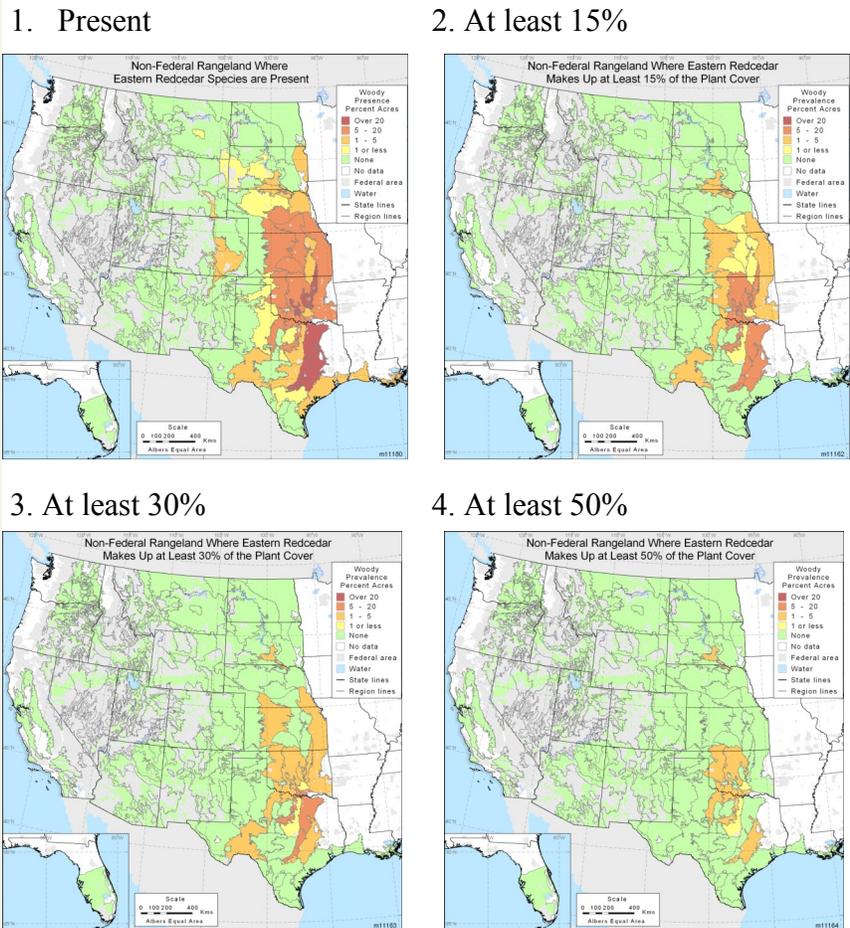
The findings presented here summarize presence and prevalence of four native invasive woody species groups:

- Junipers including eastern redcedar
- Eastern redcedar
- Junipers excluding eastern redcedar
- Mesquite.

Quality assurance and statistical procedures

Gulf Coast. Nationally, eastern redcedar is present on small percentage (1.8%) of our Nation’s non-Federal rangeland (Figure 1, Table 2) and most prevalent in the Midwest and eastern part of Texas (Figures 2-4, Table 3).

Figure 1-4. Non-Federal rangeland where eastern redcedar is present or makes up at least 15, 30, or 50 percent of the plant cover



are designed/developed to ensure data are scientifically legitimate. Irrespective of the scale of analysis, margins of error must be considered. Margins of error (at the 95 percent confidence level) are presented for all NRI estimates.

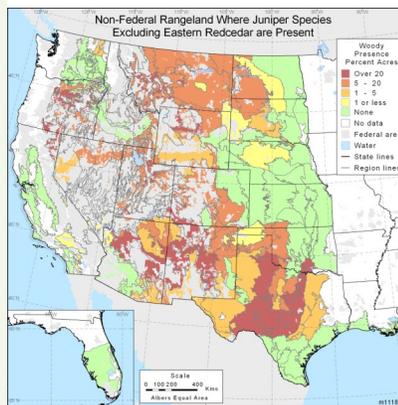
### About the Line Point Intercept Protocol

Line point intercept data are utilized in summaries of non-native plant species, non-native invasive herbaceous species, native invasive woody species, and bare ground. Line point intercept data are collected along two intersecting 150-foot transects centered on each sample location. Data collectors record plant species, litter, lichen, moss, rock fragment, bedrock, and/or bare soil present at each 3-foot interval.

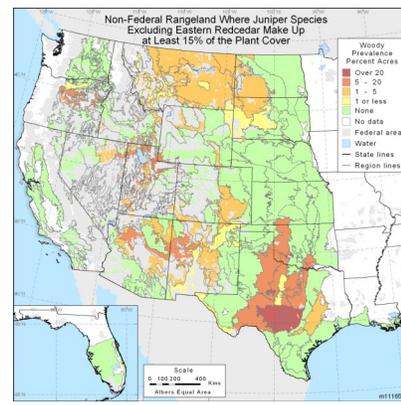
- Native invasive juniper species excluding eastern redcedar are present on 10.0 percent of the Nation’s non-Federal rangeland (Figures 5-8, Tables 2 and 4).

Figures 5-8. Non-Federal rangeland where native invasive juniper species excluding eastern redcedar are present or make up at least 15, 30, or 50 percent of the plant cover

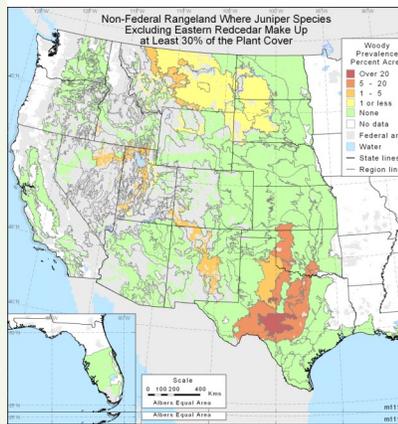
5. Present



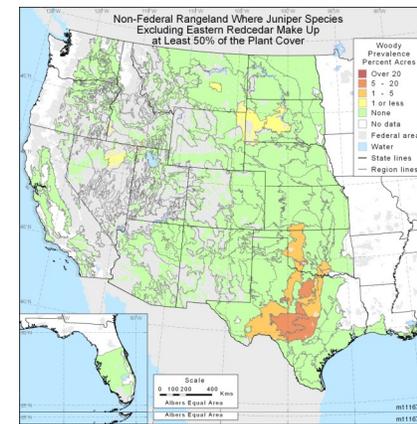
6. At least 15%



7. At least 30%



8. At least 50%



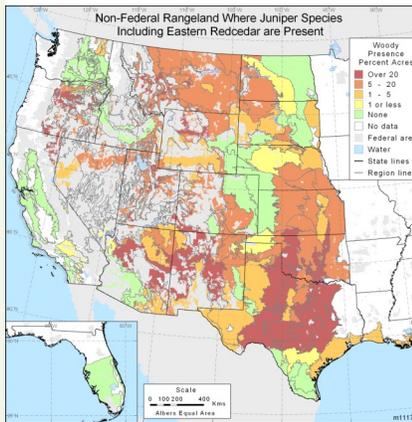
**About the Native Invasive Woody Species Maps**

The are constructed with NRI rangeland data collected in the field on rangeland during the period 2003 to 2006. The maps present the percent by classes (none, 1% or less, 1-5%, 5-20%, over 20%) of non-Federal rangeland where native invasive woody species groups are present or comprise at least 15%, 30%, or 50% of the plant cover. The regions are based on Common Resource Area (CRA) boundaries; in some cases CRAs were combined to increase the number of sample sites for which the data are summarized. Regions without non-Federal rangeland are described as “No data”. Areas of Federal land are depicted with cross-hatching.

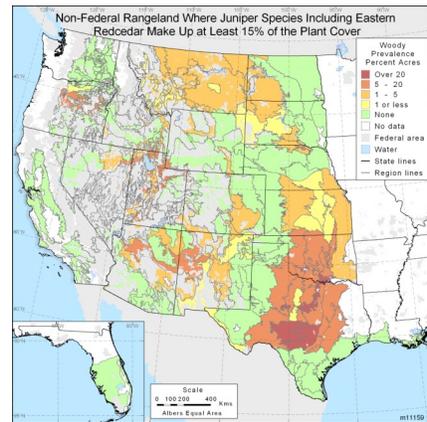
- Where fire has been prevented and controlled, native juniper species (including eastern redcedar) often invade (Figures 9-12, Tables 2 and 5) and once established, these species can out-compete the native grasses and forbs.

Figures 9-12. Non-Federal rangeland where native juniper species including eastern redcedar are present or make up at least 15, 30, or 50 percent of the plant cover

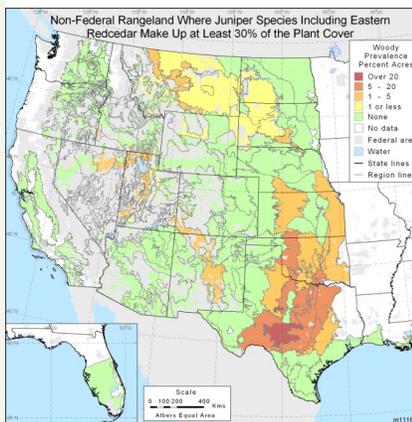
9. Present



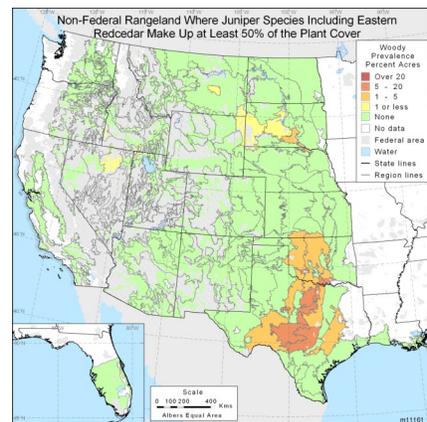
10. At least 15%



11. At least 30%



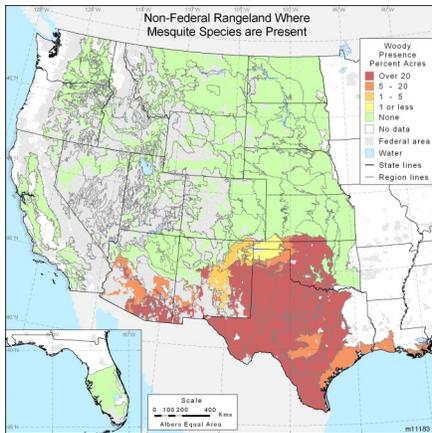
12. At least 50%



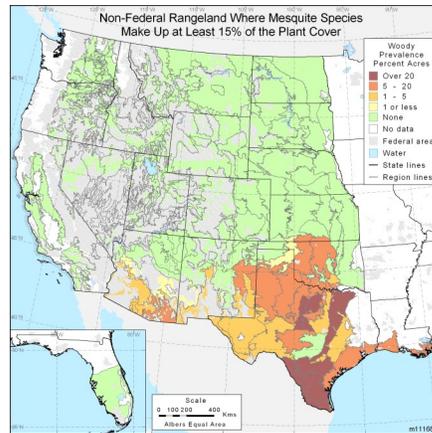
- Native invasive mesquite species (Figures 13-16, Tables 2 and 6) are present on 14.1 percent of the Nation’s non-Federal rangeland and most are concentrated in four states (Texas, Oklahoma, New Mexico, and Arizona).

Figures 13-16. Non-Federal rangeland where native invasive mesquite species are present or make up at least 15, 30, or 50 percent of the plant cover

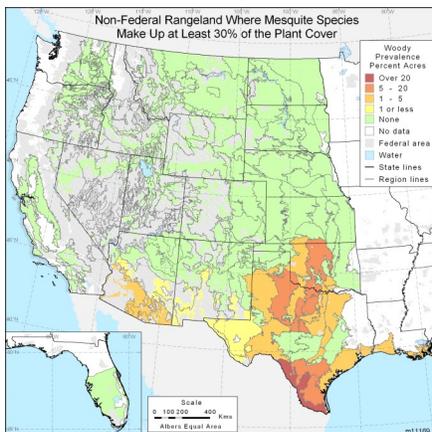
13. Present



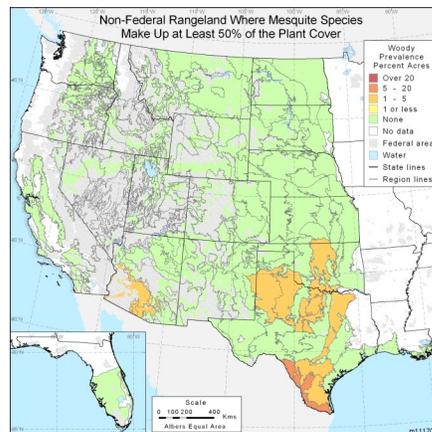
14. At least 15%



15. At least 30%



16. At least 50%



### Significance of Findings

- “Stewardship of vegetation composition, cover, and production is the foundation of sustainable rangeland management. A key component of rangeland ecosystem management is maintaining vegetation ground cover and productivity within a desirable mix of herbaceous and woody plants” (Archer et al. 2010).
- “One of the most striking land cover changes on rangeland worldwide over the past 150

years has been the proliferation of trees and shrubs at the expense of perennial grasses. In some cases, native woody plants are increasing in stature and density within their historic geographic ranges; and in other cases non-native woody plants are becoming dominant. These shifts in the balance between woody and herbaceous vegetation represent a fundamental alteration of habitat for animals (microbes, invertebrates, and vertebrates) and hence a marked alteration of ecosystem trophic structure” (Archer et al. 2010).

- “In arid and semi-arid regions, increases in the abundance of xerophytic shrubs at the expense of mesophytic grasses represents a type of desertification often accompanied by accelerated rates of wind and water erosion. In semi-arid and sub-humid areas, encroachment of shrubs and trees into grasslands and savannas may substantially promote primary production, nutrient cycling and accumulation of soil organic matter but potentially reduce stream flow, ground water recharge, livestock production and biological diversity” (Archer et al. 2010).
- The ability to predict changes in landscapes characterized by mixtures of herbaceous vegetation and woody plants began to emerge among the top priorities for global change research in the mid- to late 1990s (Daly et al. 2000; Houghton et al. 1999). The net result is a dramatic increase in wind and erosion resulting from increased bare areas in shrublands compared to the grasslands they replaced. Aeolian sediment flux in mesquite-dominated shrublands in the Chihuahuan Desert are ten-fold greater than rates of wind erosion and dust emission from grasslands on similar soils (Gillette and Pitchford 2004).
- An improvement in our ability to accurately estimate vegetation biomass across large areas is required to reduce uncertainty in terrestrial carbon pool estimates (Schimel et al., 2006).
- Therefore, these new maps developed by NRI represent a way forward to accomplish several priority ecological goals.

### **Importance to the Nation**

Certain woody invasive plant species, once established have the potential to outcompete native grasses and forbs. Loss of native species negatively impacts quality of forage for grazing livestock and can lead to land degradation and erosion. Land managers and policymakers need this information to support strategic decisions and to identify areas of risk and implement strategies to eradicate and control the spread of invasive species.

## **Tables and Results**

Estimates presented here are based upon rangeland data collected on-site as part of the National Resources Inventory (NRI), a sample survey based upon scientific statistical principles and procedures. These results are based upon NRI rangeland data collected in the field on rangeland during the period 2003 to 2006 and address current conditions. These estimates cover non-Federal rangeland in 17 western states (extending from North Dakota south to Texas and west) and to a limited extent in Florida and Louisiana.

Margins of error are reported for each NRI estimate and must be considered at all scales of analysis. The margin of error is used to construct the 95 percent confidence interval for the estimate. The lower bound of the interval is obtained by subtracting the margin of error from the estimate; the upper bound is obtained by adding the margin of error to the estimate. A 95 percent confidence interval means that in repeated samples from the same population, 95 percent of the time the true underlying population parameter will be contained within the lower and upper bounds of the interval. In the following tables, if there are instances where the margin of error is greater than or equal to the estimate, the confidence interval includes zero and the estimate should not be used. In those cases, the estimate in the table is replaced by the word “Trace.”

Table 1. Invasive Woody Species Groups

Juniper\*

- JUAS - *Juniperus ashei* J. Buchholz, Ashe's juniper, Cupressaceae
- JUCA7 - *Juniperus californica* Carrière, California juniper, Cupressaceae
- JUCO11 - *Juniperus coahuilensis* (Martínez) Gaussen ex R.P. Adams, redberry juniper, Cupressaceae
- JUCO6 - *Juniperus communis* L., common juniper, Cupressaceae
- JUDE2 - *Juniperus deppeana* Steud., alligator juniper, Cupressaceae
- JUHO2 - *Juniperus horizontalis* Moench, creeping juniper, Cupressaceae
- JUMO - *Juniperus monosperma* (Engelm.) Sarg., oneseed juniper, Cupressaceae
- JUNIP - *Juniperus* L., juniper, Cupressaceae
- JUOC - *Juniperus occidentalis* Hook., western juniper, Cupressaceae
- JUOS - *Juniperus osteosperma* (Torr.) Little, Utah juniper, Cupressaceae
- JUPI - *Juniperus pinchotii* Sudw., Pinchot's juniper, Cupressaceae
- JUSC2 - *Juniperus scopulorum* Sarg., Rocky Mountain juniper, Cupressaceae
- JUVI - *Juniperus virginiana* L., Eastern redcedar, Cupressaceae

\* Three juniper summaries include:

- Junipers including Eastern redcedar
- Eastern redcedar only
- Junipers excluding Eastern redcedar

Mesquite

- PROSO - *Prosopis* L., mesquite
- PRGL2 - *Prosopis glandulosa* Torr., honey mesquite
- PRJU3 - *Prosopis juliflora* (Sw.) DC., mesquite
- PRVE - *Prosopis velutina* Woot., velvet mesquite
  - PRJU, *Prosopis juliflora*
- PRGLG - *Prosopis glandulosa* Torr. var. *glandulosa*, honey mesquite (Note: none in database)
  - PRJU, *Prosopis juliflora*

Table 2. Non-Federal Rangeland Where Native Invasive Woody Species Groups Are Present, by State, with Margins of Error

| State        | Eastern Redcedar | Juniper Species Excluding Eastern Redcedar | Juniper Species Including Eastern Redcedar | Mesquite Species |
|--------------|------------------|--|--|------------------|
|              | <i>Percent</i>   | <i>Percent</i>                             | <i>Percent</i>                             | <i>Percent</i>   |
| Arizona      | 0<br>NA          | 13.0<br>±4.9                               | 13.0<br>±4.9                               | 14.0<br>±3.6     |
| California   | 0<br>NA          | Trace                                      | Trace                                      | 0<br>NA          |
| Colorado     | Trace            | 7.6<br>±3.7                                | 8.3<br>±4.0                                | 0<br>NA          |
| Florida      | 0<br>NA          | 0<br>NA                                    | 0<br>NA                                    | 0<br>NA          |
| Idaho        | 0<br>NA          | 4.0<br>±2.8                                | 4.0<br>±2.8                                | 0<br>NA          |
| Kansas       | 5.1<br>±1.8      | 0<br>NA                                    | 5.1<br>±1.8                                | 0<br>NA          |
| Louisiana    | 0<br>NA          | 0<br>NA                                    | 0<br>NA                                    | 0<br>NA          |
| Montana      | 0<br>NA          | 12.2<br>±3.9                               | 12.2<br>±3.9                               | 0<br>NA          |
| Nebraska     | 4.6<br>±1.9      | 0<br>NA                                    | 4.6<br>±1.9                                | 0<br>NA          |
| Nevada       | 0<br>NA          | Trace                                      | Trace                                      | 0<br>NA          |
| New Mexico   | 0<br>NA          | 12.9<br>±5.7                               | 12.9<br>±5.7                               | 14.1<br>±4.4     |
| North Dakota | 0<br>NA          | 6.8<br>±2.5                                | 6.8<br>±2.5                                | 0<br>NA          |
| Oklahoma     | 20.4<br>±4.7     | Trace                                      | 21.3<br>±4.1                               | 7.5<br>±4.2      |
| Oregon       | 0<br>NA          | 13.3<br>±4.2                               | 13.3<br>±4.2                               | 0<br>NA          |
| South Dakota | Trace            | Trace                                      | 1.2<br>±1.1                                | 0<br>NA          |
| Texas        | 2.6<br>±0.8      | 19.2<br>±4.5                               | 21.5<br>±4.5                               | 47.6<br>±4.5     |
| Utah         | 0<br>NA          | 20.3<br>±8.9                               | 20.3<br>±8.9                               | 0<br>NA          |
| Washington   | 0<br>NA          | 0<br>NA                                    | 0<br>NA                                    | 0<br>NA          |
| Wyoming      | 0                | 3.1  | 3.1  | 0                |
| Nation       | 1.8<br>±0.3      | 10.0<br>±1.2                               | 11.8<br>±1.3                               | 14.1<br>±1.2     |

Notes: Estimates where margins of error are at least as large as the estimates are denoted as “Trace.”

Table 3. Non-Federal Rangeland Where Native Invasive Eastern Redcedar Make Up at Least 5, 15, 30, or 50 Percent of the Plant Cover, by State, with Margins of Error

| State        | At Least 5%    | At Least 15%   | At Least 30%   | At Least 50%   |
|--------------|----------------|----------------|----------------|----------------|
|              | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Arizona      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| California   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Colorado     | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Florida      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Idaho        | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Kansas       | 1.8<br>±1.2    | Trace          | 0<br>NA        | 0<br>NA        |
| Louisiana    | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Montana      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nebraska     | Trace          | Trace          | Trace          | 0              |
| Nevada       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| New Mexico   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| North Dakota | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Oklahoma     | 10.9<br>±4     | 6.0<br>±3.1    | 2.7<br>±2.3    | Trace          |
| Oregon       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| South Dakota | Trace          | Trace          | Trace          | Trace          |
| Texas        | 1.5<br>±0.8    | 0.8<br>±0.6    | Trace          | Trace          |
| Utah         | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Washington   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Wyoming      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nation       | 0.9<br>±0.3    | 0.5<br>±0.2    | 0.3<br>±0.2    | Trace          |

Notes: Estimates where margins of error are at least as large as the estimates are denoted as “Trace.”

Table 4. Non-Federal Rangeland Where Native Invasive Juniper Species Excluding Eastern Redcedar Make Up at Least 5, 15, 30, or 50 Percent of the Plant Cover, by State, with Margins of Error

| State        | At Least 5%    | At Least 15%   | At Least 30%   | At Least 50%   |
|--------------|----------------|----------------|----------------|----------------|
|              | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Arizona      | 8.3<br>±3.9    | 3.5<br>±2.7    | 0<br>NA        | 0<br>NA        |
| California   | Trace          | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Colorado     | 4.5<br>±3.0    | Trace          | Trace          | 0<br>NA        |
| Florida      | Trace          | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Idaho        | 2.7<br>±2.0    | Trace          | Trace          | Trace          |
| Kansas       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Louisiana    | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Montana      | 5.9<br>±2.4    | 3.0<br>±2.2    | Trace          | 0<br>NA        |
| Nebraska     | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nevada       | Trace          | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| New Mexico   | 5.6<br>±4.2    | Trace          | Trace          | 0<br>NA        |
| North Dakota | 4.4<br>±2.5    | 2.5<br>±2.2    | Trace          | 0<br>NA        |
| Oklahoma     | Trace          | Trace          | 0<br>NA        | 0<br>NA        |
| Oregon       | 6.6<br>±2.7    | Trace          | 0<br>NA        | 0<br>NA        |
| South Dakota | Trace          | Trace          | Trace          | Trace          |
| Texas        | 12.5<br>±3.3   | 7.2<br>±2.2    | 4.4<br>±1.6    | 2.2<br>±1.2    |
| Utah         | 10.2<br>±6.9   | 4.1<br>±3.4    | 1.0<br>±0.8    | 0<br>NA        |
| Washington   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Wyoming      | Trace          | Trace          | Trace          | 0<br>NA        |
| Nation       | 5.8            | 2.7            | 1.3            | 0.5            |

Notes: Estimates where margins of error are at least as large as the estimates are denoted as “Trace.”

Table 5. Non-Federal Rangeland Where Native Invasive Juniper Species Including Eastern Redcedar Make Up at Least 5, 15, 30, or 50 Percent of the Plant Cover, by State, with Margins of Error

| State        | At Least 5%    | At Least 15%   | At Least 30%   | At Least 50%   |
|--------------|----------------|----------------|----------------|----------------|
|              | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Arizona      | 8.3<br>±3.9    | 3.5<br>±2.7    | 0<br>NA        | 0<br>NA        |
| California   | Trace          | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Colorado     | 4.5<br>±3.0    | Trace          | Trace          | 0<br>NA        |
| Florida      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Idaho        | 2.7<br>±2.0    | Trace          | Trace          | Trace          |
| Kansas       | 1.8<br>±1.2    | Trace          | 0<br>NA        | 0<br>NA        |
| Louisiana    | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Montana      | 5.9<br>±2.4    | 3.0<br>±2.2    | Trace          | 0<br>NA        |
| Nebraska     | Trace          | Trace          | Trace          | 0<br>NA        |
| Nevada       | Trace          | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| New Mexico   | 5.6<br>±4.2    | Trace          | Trace          | 0<br>NA        |
| North Dakota | 4.4<br>±2.5    | 2.5<br>±2.2    | Trace          | 0<br>NA        |
| Oklahoma     | 11.4<br>±3.8   | 6.5<br>±3.1    | 2.7<br>±2.3    | Trace          |
| Oregon       | 6.6<br>±2.7    | Trace          | 0<br>NA        | 0<br>NA        |
| South Dakota | Trace          | Trace          | Trace          | Trace          |
| Texas        | 13.9<br>±3.4   | 7.9<br>±2.3    | 5.1<br>±1.8    | 2.5<br>±1.3    |
| Utah         | 10.2<br>±6.9   | 4.1<br>±3.4    | 1.0<br>±0.8    | 0<br>NA        |
| Washington   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Wyoming      | Trace          | Trace          | Trace          | 0              |
| Nation       | 6.7<br>±1      | 3.1<br>±0.6    | 1.5<br>±0.4    | 0.7<br>±0.3    |

Notes: Estimates where margins of error are at least as large as the estimates are denoted as “Trace.”

Table 6. Non-Federal Rangeland Where Native Invasive Mesquite Species Make Up at Least 5, 15, 30, or 50 Percent of the Plant Cover, by State, with Margins of Error

| State        | At Least 5%    | At Least 15%   | At Least 30%   | At Least 50%   |
|--------------|----------------|----------------|----------------|----------------|
|              | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> | <i>Percent</i> |
| Arizona      | 7.8<br>±2.6    | 1.6<br>±1.1    | Trace          | Trace          |
| California   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Colorado     | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Florida      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Idaho        | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Kansas       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Louisiana    | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Montana      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nebraska     | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nevada       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| New Mexico   | 5.7<br>±2.1    | 1.2<br>±0.9    | Trace          | Trace          |
| North Dakota | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Oklahoma     | 3.9<br>±2.2    | 2.4<br>±1.9    | Trace          | Trace          |
| Oregon       | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| South Dakota | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Texas        | 30.9<br>±3.9   | 14.5<br>±2     | 7.0<br>±1.8    | 1.9<br>±0.8    |
| Utah         | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Washington   | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Wyoming      | 0<br>NA        | 0<br>NA        | 0<br>NA        | 0<br>NA        |
| Nation       | 8.6<br>±1      | 3.8<br>±0.6    | 1.8<br>±0.4    | 0.5<br>±0.2    |

Notes: Estimates where margins of error are at least as large as the estimates are denoted as “Trace.”

## More Information

For more information about the NRI, visit <http://www.nrcs.usda.gov/technical/NRI/>.

More information about the USDA Plants Database may be found at <http://plants.usda.gov/>.

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Send comments and questions to the NRI Help Desk ([nri@wdc.usda.gov](mailto:nri@wdc.usda.gov)).