

Old World Bluestems – An Invasive Threat to the Southwest

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Old World bluestems (OWBs)

- Warm-season, perennial bunchgrasses that have become invasive, particularly in the Midwest, OK, and TX.
- Includes yellow bluestem (*Bothriochloa ischaemum*) and Caucasian bluestem (*B. bladhii*).
- Originally imported from Eurasia and Africa in the early 1900s as forage crops and for erosion control.



Old World bluestems
(*Bothriochloa*, *Dichanthium*, and
Capillipedium spp.)

vs.

North American bluestems/beardgrasses
(*Andropogon*, *Schizachyrium*, and
Bothriochloa spp.)



Yellow
bluestem



Caucasian
bluestem



Big bluestem



Little
bluestem



Silver bluestem/
beardgrass

OWB identification



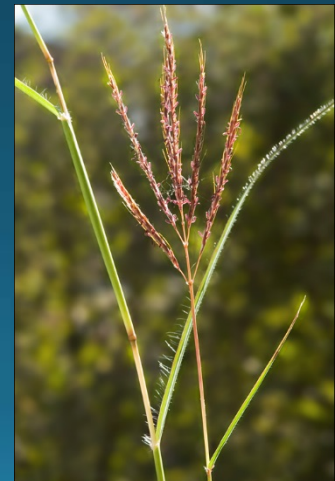
- Both yellow and Caucasian bluestems are not readily identified as they typically don't stand out except for a light green color during the growing season.



- OWBs have a blondish straw color in the dormant season.

Yellow bluestem identification

- Yellow bluestem is named for pale yellow color on stems that transitions into green.
- Lateral inflorescence branches are longer than the central inflorescence branch giving the panicle a fan or finger-like appearance.
- Inflorescence is usually reddish-purple but can be white depending on cultivar (e.g., 'Plains' cultivar)



Caucasian bluestem identification

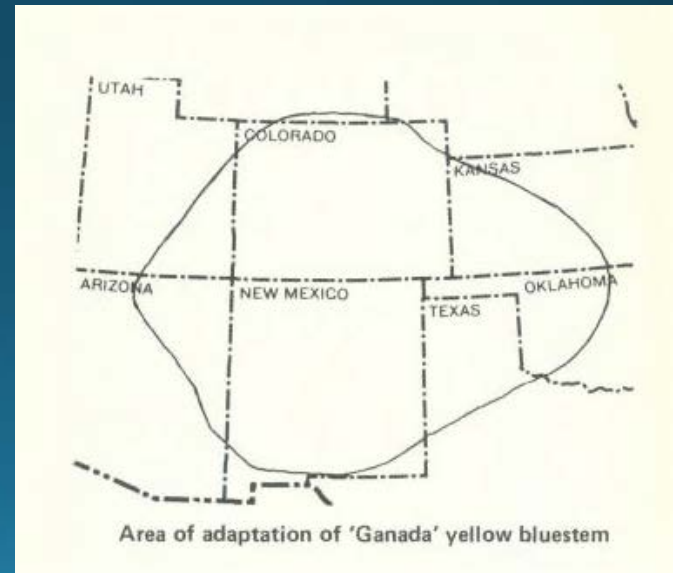


- Lateral inflorescence branches are not as long as the central branch, which gives the panicle an “evergreen tree” appearance.
- Slender blue-green leaves with thick midveins
- Can have a sweetish, aromatic smell



OWB cultivars

- Germplasm for OWB cultivars was collected from globally dispersed varieties and developed for release by USDA agencies and State agricultural experiment stations.
- Cultivars are adapted to different disease and insect threats, climate, and soil-site conditions.
- Most common YB cultivars are
 - 1) 'Plains'
 - 2) 'King Ranch'
 - 3) 'Ganada'
 - 4) 'WW-Spar'
 - 5) 'WW-Iron Master'
- 'WW-B Dahl' is the sole cultivar of Caucasian bluestem.



'Plains' cultivar of yellow bluestem



- Has whitish, fan-like panicle rather than reddish purple coloration
- Developed from 30 varieties
- Widely planted in western OK but is also present in eastern NM
- Relatively more palatable than other cultivars



OWB uses

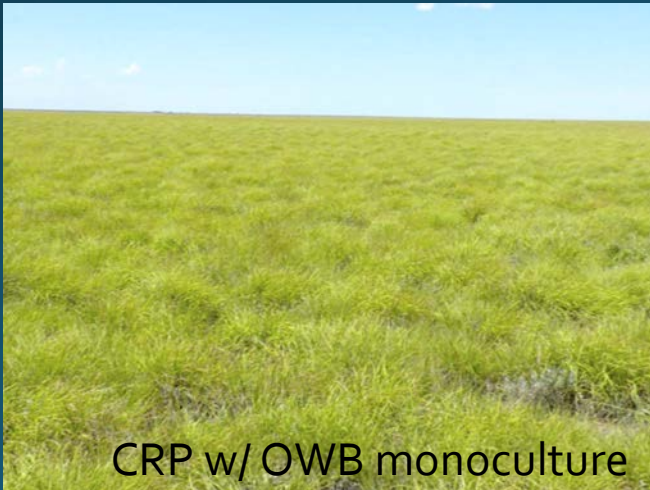
- Most common use for OWBs is forage, either for grazing or hay.
- OWBs are palatable when young and may have equal or greater forage quality in early growth stages as compared to some native species. However, OWBs mature more quickly than most natives and become less palatable and less nutritious.
- Although livestock tend to avoid eating OWBs when possible, OWBs can be highly selected by grazers during drought periods.



OWB uses



- Some State DOTs and county highway departments have seeded OWBs in ROWs for erosion control, as they are readily established and can provide a quick ground cover.



CRP w/ OWB monoculture

- YB has been used in the Conservation Reserve Program (CRP) and planted in Dust Bowl areas of the Southern Great Plains to prevent soil erosion.

OWB traits

- OWBs have a number of characteristics common to invasive weeds including –
 - 1) Fast growth
 - 2) Rapid reproduction
 - 3) High dispersal capability
 - 4) Tolerance to a wide range of environmental conditions



OWB traits



- Highly aggressive and very adaptable, especially in disturbed areas.
- Drought-resistant, extremely persistent plants that can outperform many native grasses under arid conditions.
- Do well on any well-drained, non-saline soil and can adapt to highly calcareous soils with high pH.
- Not adapted to cold climates or shady conditions

OWB traits

- Both OWB species reproduce by producing seed (a caryopsis) as well as vegetatively under certain conditions via rhizomes (underground stems) and stolons (aboveground runners).
- If unassisted, OWB seed has relatively limited dispersion. However, seeds readily disperse via other means of transport (vehicles, wind, water, etc.).
- Seed of both OWB species is readily available from seed companies.



OWB impacts



- Potential to develop monocultures that lower biodiversity and transform grasslands at the community and ecosystem levels of organization
- Reduction in abundance, diversity, and richness in native plant communities
- Loss of forbs can reduce insects, especially pollinators
- May impact wilderness areas and T&E species such as Holy Ghost ipomopsis (*Ipomopsis sancti-spiritus*)



OWB impacts

- During periods of adequate moisture, OWBs are generally avoided by grazing animals in favor of native vegetation thereby giving OWBs a competitive edge.
- OWBs retain green leaf material longer than native species at the onset of drought, which allows OWBs to recover more rapidly when precipitation eventually returns.
- OWB plants left ungrazed causes accumulation of dead standing material, which discourages further utilization.



OWB impacts



- Alters soil C:N ratios and soil microbial communities (including arbuscular mycorrhizae), which can inhibit growth of native plants
- Leachate studies with yellow bluestem indicate that the species has allelopathic compounds that can inhibit seed germination, growth, and survival in other plant species.

OWB impacts

- Nutrition and habitat for wildlife in OWB-dominated areas can be poor.
- For some grassland bird species, OWB-infested lands are unsuitable for nesting, brood-rearing, or year-round habitat.
- Decline in arthropod abundance and/or biomass may result in overall lower bird numbers.



OWB establishment



- OWBs infest both disturbed and non-disturbed sites in native grasslands and pastures; however, they tend to establish more readily on disturbed sites.
- Establish principally along roadsides, but they also establish in other disturbed areas such as oil well pads, dams, cattle trails, etc.
- Some OWB infestations in native plant communities have been initiated by seeding in ROWs, farmlands, and lands involved with CRP and the Bankhead-Jones Farm Tenant Act of 1937.

OWB spread

- Seeds readily disperse via mowing, grading, vehicular traffic, flowing water, and winds moving across open terrain.
- Once established, OWBs can then spread away in an “advancing front.”
- In addition to spreading OWB seed along roadsides, mowing also promotes monocultures in ROWs.



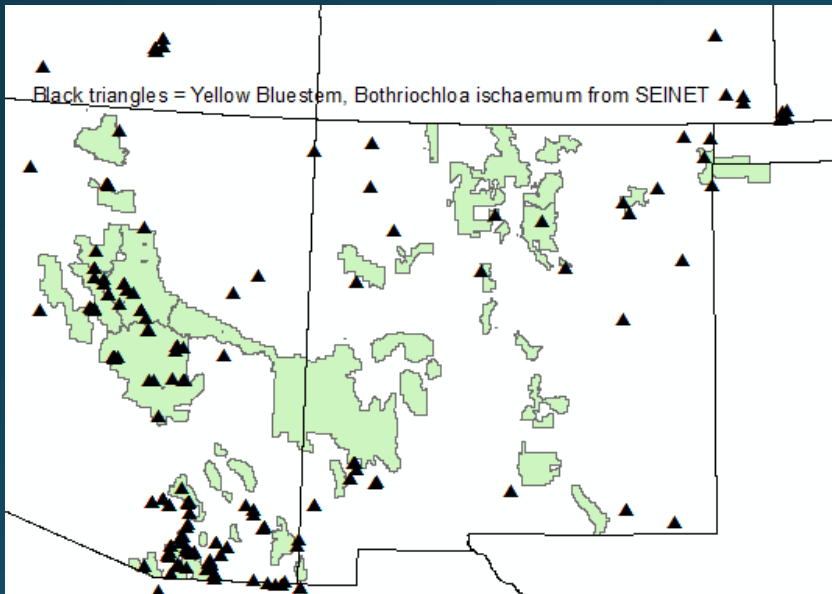
The Nature Conservancy

YB on Hwy 14 east of Albuquerque

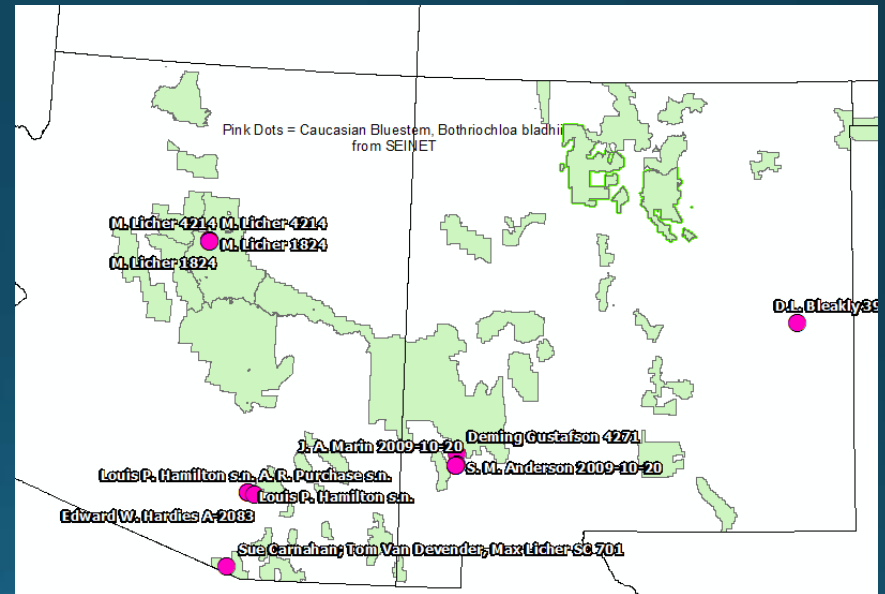


OWB records in SEINet plants database*

- Yellow bluestem



- Caucasian bluestem



* National Forest System lands are highlighted in green.

2017 survey for YB on National Forest System lands in Region 3

- In 2017, national forests and grasslands in Region 3 (AZ and NM) conducted informal “windshield” surveys for YB presence.
- Forests and grasslands were asked to identify presence of YB (if any) across all Districts as much as possible.



OWBs in Region 3



- Yellow bluestem was reported to be either directly on or close to nearly all national forests and national grasslands in Region 3.
- Caucasian bluestem was found along FS Road 535 on the Coconino NF. May also be present on Coronado and Gila NFs according to SEINet.
- Kiowa (shown), Rita Blanca, and Black Kettle national grasslands all have yellow bluestem originating from CRP, Bankhead-Jones Act lands, or nearby landownerships.

Black Kettle NG

- 'Plains' cultivar of YB is widespread throughout Roger Mills County in OK and is still being planted by producers. The County highway dept. has also planted YB along ROWs.
- 'Plains' cultivar displaces most grasses, even weeping lovegrass.
- Black Kettle NG tries to manage heavy infestations by intense grazing during growing season.



Black Kettle NG



Santa Fe NF

- YB is growing in pinon/juniper grassland and rock escarpments away from any road or disturbed area.
- YB and silver bluestem grow in thick complexes along riparian areas of the Pecos River.



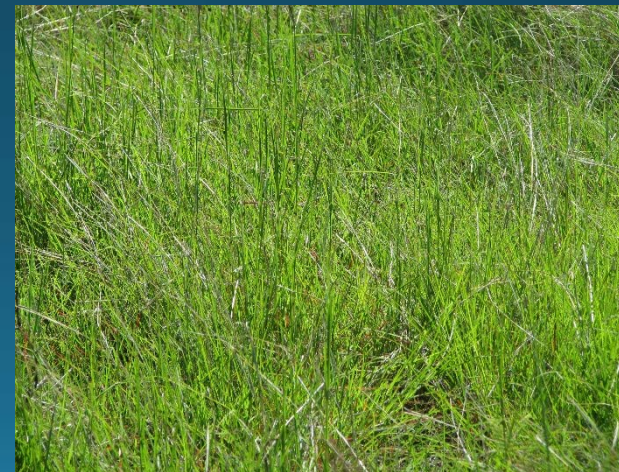
Santa Fe NF



- Small YB infestations (< 1 ac.) along Forest Service Road 326 on Rowe Mesa were probably established by road equipment or vehicle traffic.
- Elevation of YB is 6,700 feet, which is within range of many wilderness elevations in R3.

Coronado NF – Aug. 2017

- Sierra Vista and Nogales Ranger Districts has up to 2,000 acres of a complex of YB and Lehmann lovegrass.
- YB became established after Ryan fire of 2002.
- Expansion of YB and Lehmann lovegrass on the two Districts has lowered biodiversity and required changes in grazing management.



Coronado NF – Oct. 2018



- Panicle branches fall off in late season giving a whip-like appearance to stems.
- Native species are still present but may not persist indefinitely if YB monoculture develops.
- Unlike the Midwest, YB infestations in the Southwest may present a fire hazard.

Coronado NF



buffelgrass



fountain grass



Natal grass



Lehmann lovegrass

Cochise County, AZ

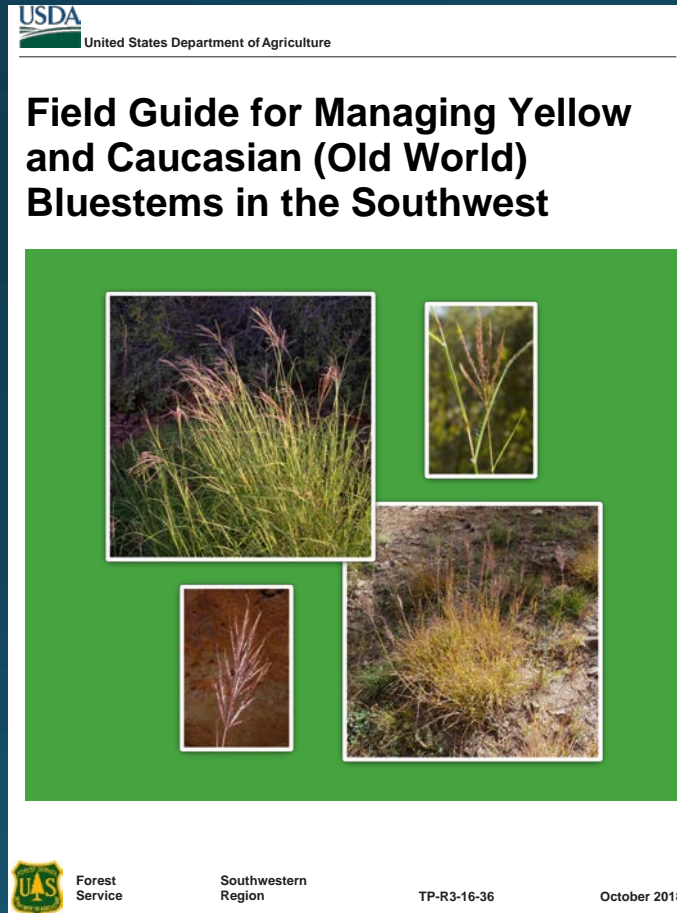


OWB management

- Once established, OWBs are practically impossible to eradicate. Therefore, it is necessary to eradicate new infestations when possible; otherwise, will need to implement management to control infestations .
- Control becomes progressively more difficult and expensive the longer OWBs are allowed to grow and spread.
- OWBs are not listed on any State noxious weed list, including AZ and NM.



OWB weed guide



- Field guides on yellow and Caucasian bluestems and other invasive weeds are available on Region 3's website for invasive species at:
<https://www.fs.usda.gov/detail/r3/forest-grasslandhealth/invasivespecies/>
- Co-authors are Dr. Karen Hickman from OKSU and Dr. Keith Harmoney from KSU.

OWB management – prevention

- OWBs are most effectively managed by preventing their spread:
 1. Do not plant OWB seed for forage, erosion control, reclamation, or other purposes.
 2. Do not mow OWB-infested areas once seed heads have started to form.
 3. Use power washers or air compressors with a blow gun attachment to clean vehicles after traveling through OWB-infested areas.
 4. Do not feed grass hay from unknown sources or from ROWs.
 5. If re-seeding an area, do not use seed obtained from equipment that has also been used to harvest or process OWBs.

OWB management

- Grazing, mowing, or burning – applied singly or in combination – do not adequately control OWBs.
 1. Timing and frequency of these treatments may actually increase OWB vigor and make them even more competitive.
 2. Use of these treatments either prior to herbicide application or between split herbicide applications greatly increases herbicide effectiveness.

OWB management – tillage

- If OWBs infestations are in a tillable area such as old cropland, then plowing or disking can greatly reduce them. However, tillage without follow-up control measures can increase OWB densities by breaking up root masses and scattering the fragments.
 - 1) Can use tillage and seeding of an annual crop (e.g., winter wheat) for 3 or more consecutive years to provide significant OWB control.
 - 2) Reseeding to native grasses and forbs is eventually possible if coupled with several years of herbicide treatments.

OWB management – mowing

- Mowing in ROWs presents major challenge in OWB control due to need of reducing hazardous vegetation.
- Infested ROWs and other transportation corridors should not be mowed once OWB flowering heads have started to form, as this can move seed into un-infested areas.
- Mowing is more effective if combined with pre or post-herbicide treatments.



OWB management – grazing

- Stocking rates that do not account for areas occupied by OWBs can over-utilize native vegetation. Therefore, stocking should be adjusted to favor native grasses.
- Continuous, intensive grazing should be used only on lands close to full OWB monoculture; otherwise, native plants will probably be over-utilized.
- Supplemental protein may be required for grazing OWB-dominated pastures since crude protein in OWBs declines significantly in as little as 7-8 weeks after initiation of growth.



OWB management – herbicide

- Only non-selective herbicides, **glyphosate** and **imazapyr**, have been found to control OWBs adequately.
- Control on a short-term basis has been successful with both herbicides in single or split applications during the growing season:
 - 1) Glyphosate may require up to two applications during growing season, and it may initially encourage re-growth of OWBs.
 - 2) Imazapyr causes less damage to desirable warm season grasses than glyphosate.
- A mixture of imazapyr and glyphosate can also provide short-term control.

Herbicide application



- Spot, broadcast, or ropewick herbicide treatments
- Fire or mowing can be used to increase herbicide efficacy.
- If mowing is used to increase herbicide efficacy, do not mow once seed heads start to form.

Herbicide application – glyphosate and imazapyr

Application	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution)	Time of Application
Single application	2-3 lbs per acre	1.5% of a 5.5 lb per gallon product or 2.0% of a 4 lb per gallon product	Favorable growing conditions and adequate moisture should be present; apply when OWBs are in boot stage or any time prior to seed production while leaves are green and plant is actively growing.
Split application	1-2 lbs per acre	same as above	First application is at the 5-leaf stage. Second application is 8 weeks later.

Herbicide application

- Seedlings may emerge from seedbank 2-3 years after treatment. Therefore, herbicide needs to be reapplied as needed over that time period.
- Applying herbicide to OWBs as a single treatment without follow-up can be ineffective or worse than not using herbicide at all.

Long-term expansion of OWBs in the Southwest?



OWB management strategies*

Three main choices for managing invasive grasses on native lands:

- 1) Eradication – requires sustained, intensive efforts to control small OWB infestations
- 2) Diversity management – reduce OWB dominance to encourage plant diversity
- 3) Passive management (“do nothing”) – prevent disturbance that can further spread OWB infestations

* Clayton et al. 2017. Texas Agrilife Exten. Serv. ERM-036.

Forest Service management of OWBs

- Regional Forester direction given in 2018 to national forests and grasslands in Region 3 that OWBs will no longer be treated as forage grasses and that these species must be added to forest invasive weed lists for management.
- Aggressively manage OWBs by eradicating new infestations or else controlling them to the greatest extent possible.
- Reduce or eliminate yellow bluestem planted on CRP and Bankhead-Jones Act lands if possible to decrease further spread.
- Prohibit OWB seed in seed, mulch, forage, and fill materials used on NFS lands.
- Coordinate with State DOTs, county highway departments, Federal/State agencies, and adjacent landowners to limit OWB spread.

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