Need Habitat Restoration for Pollinators, Monarchs, and Sage-Grouse? Forbs are the Answer

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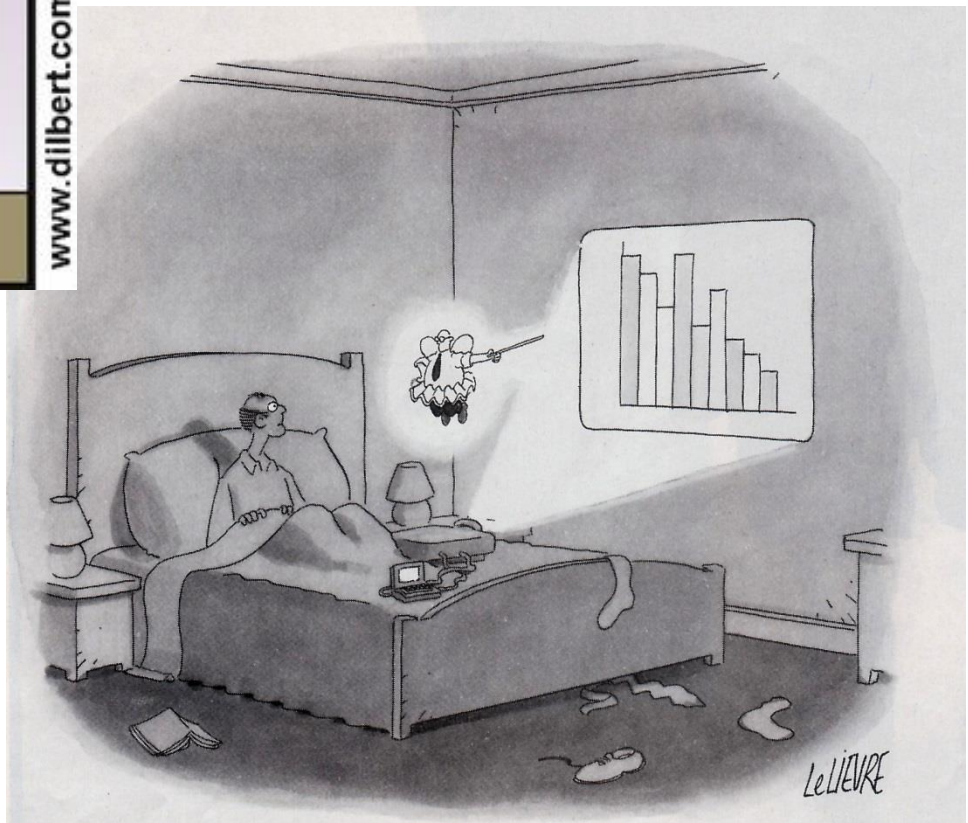
Photo courtesy David Pyke



The night before the big meeting, Kas receives a visit from the PowerPoint Fairy.

Forbs and Pollinators

The White House

Office of the Press Secretary

For Immediate Release
June 20, 2014

Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES
SUBJECT: Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

- Presidential Pollinator Memo
  - Increase habitat = more forbs
    - Temporal and species diversity

Photo by Kas Dumroese

Pollinators Like Forbs!

- Species level
- Genus level
- Spatial and temporal aspects

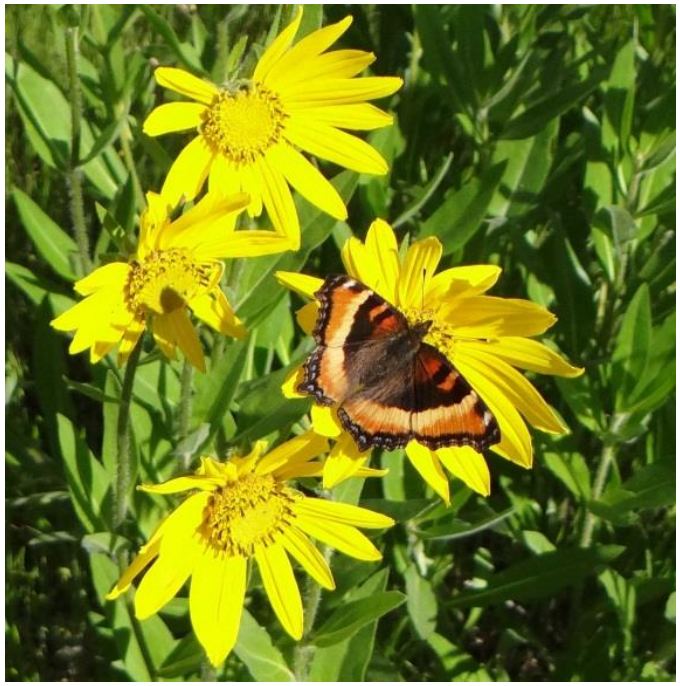
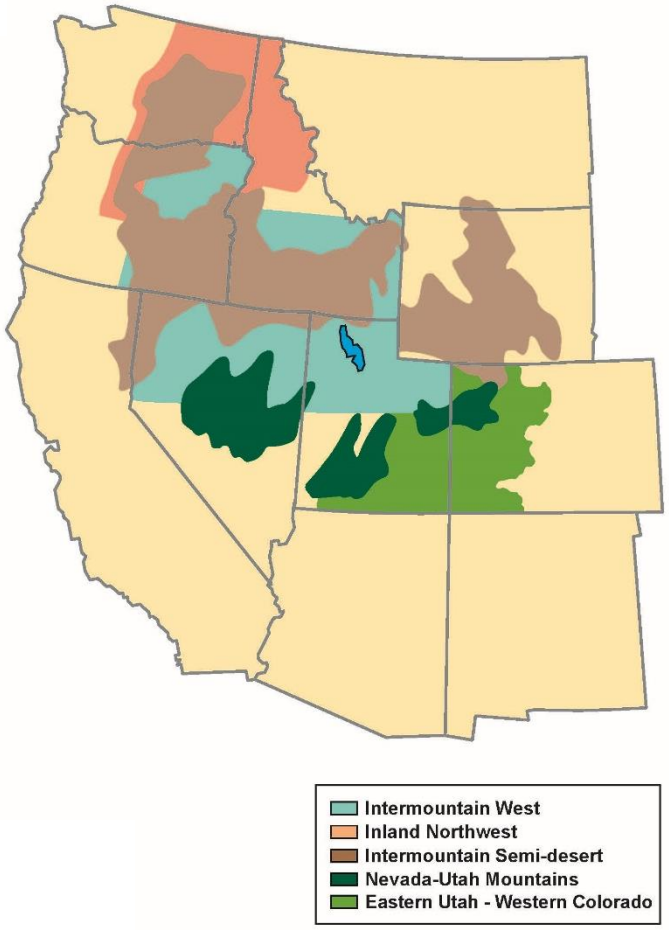


Photo by Kas Dumroese

Forbs and Pollinators



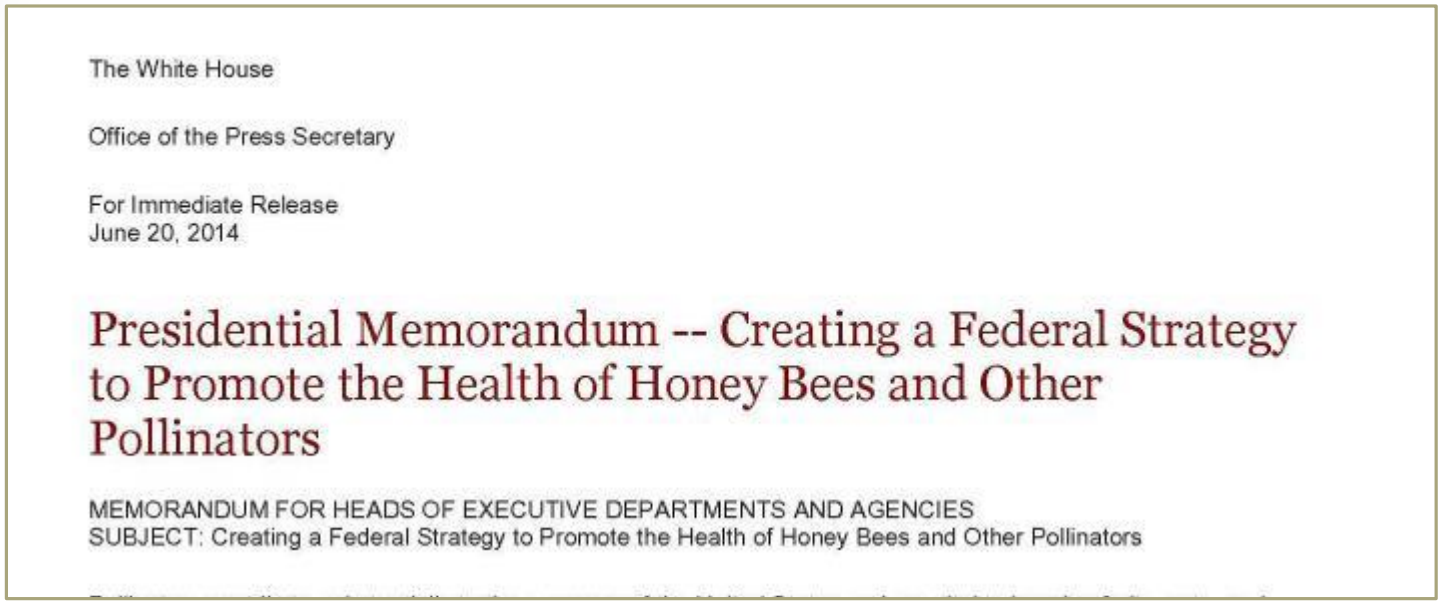
Recommendations?

On-line sources:

NRCS
Xerces Society
State native plant societies

www.pollinator.org
pugetsoundbees.org

Forbs and Monarchs



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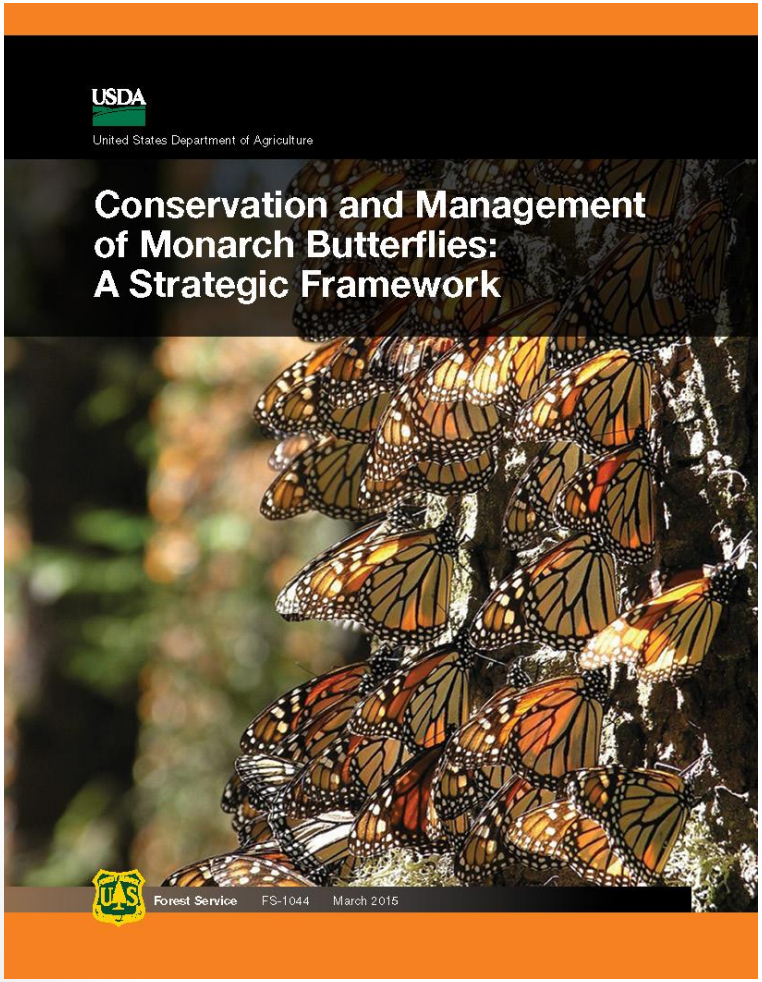
We will continue to collaborate in the protection of our region's biodiversity and to address other environmental challenges... Our governments will establish a working group to ensure the conservation of the Monarch butterfly, a species that symbolizes our association"

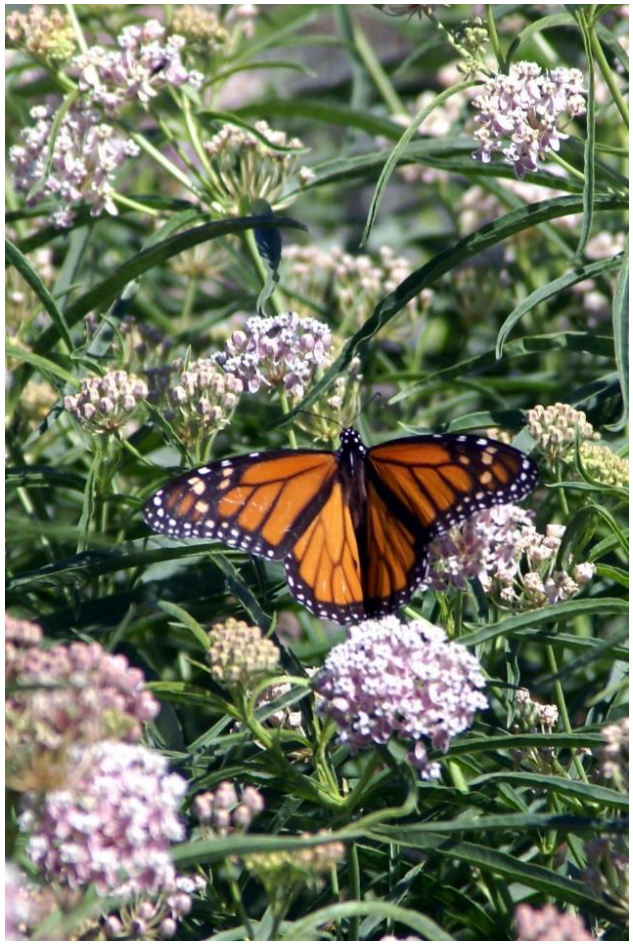
Forest Service Response



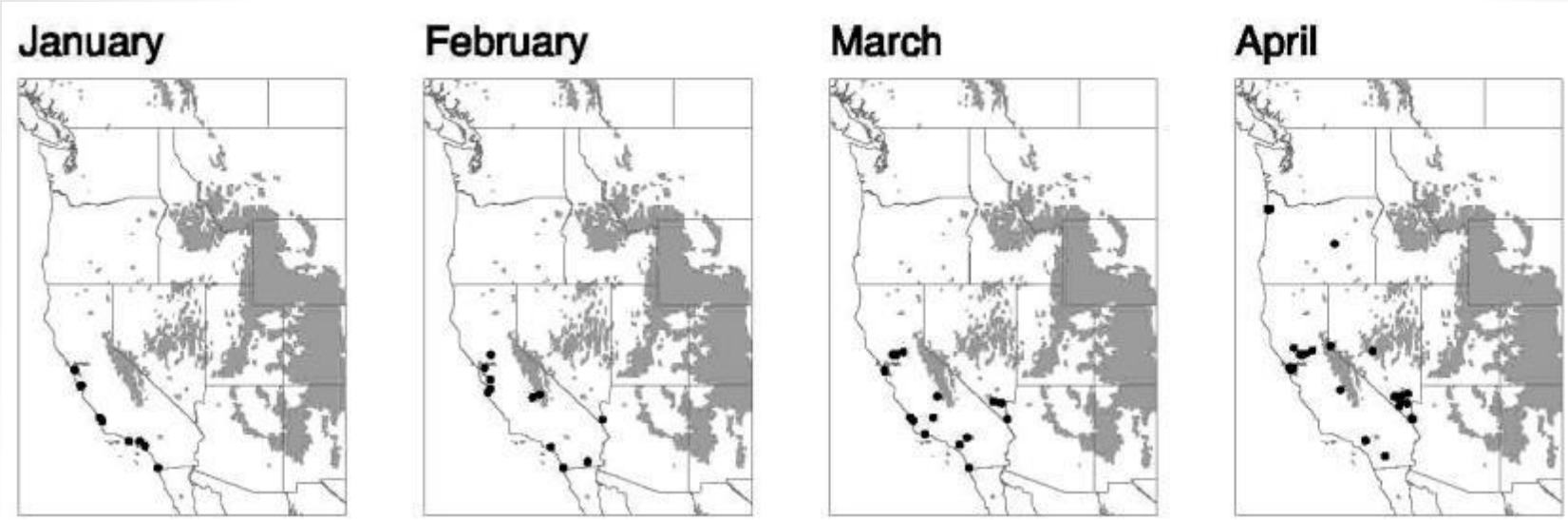
Conservation and Management of Monarch Butterflies: A Strategic Framework

Forbs and Monarchs

- Adults floral generalists
- Caterpillars milkweed obligates
- Milkweed flowers great for all pollinators

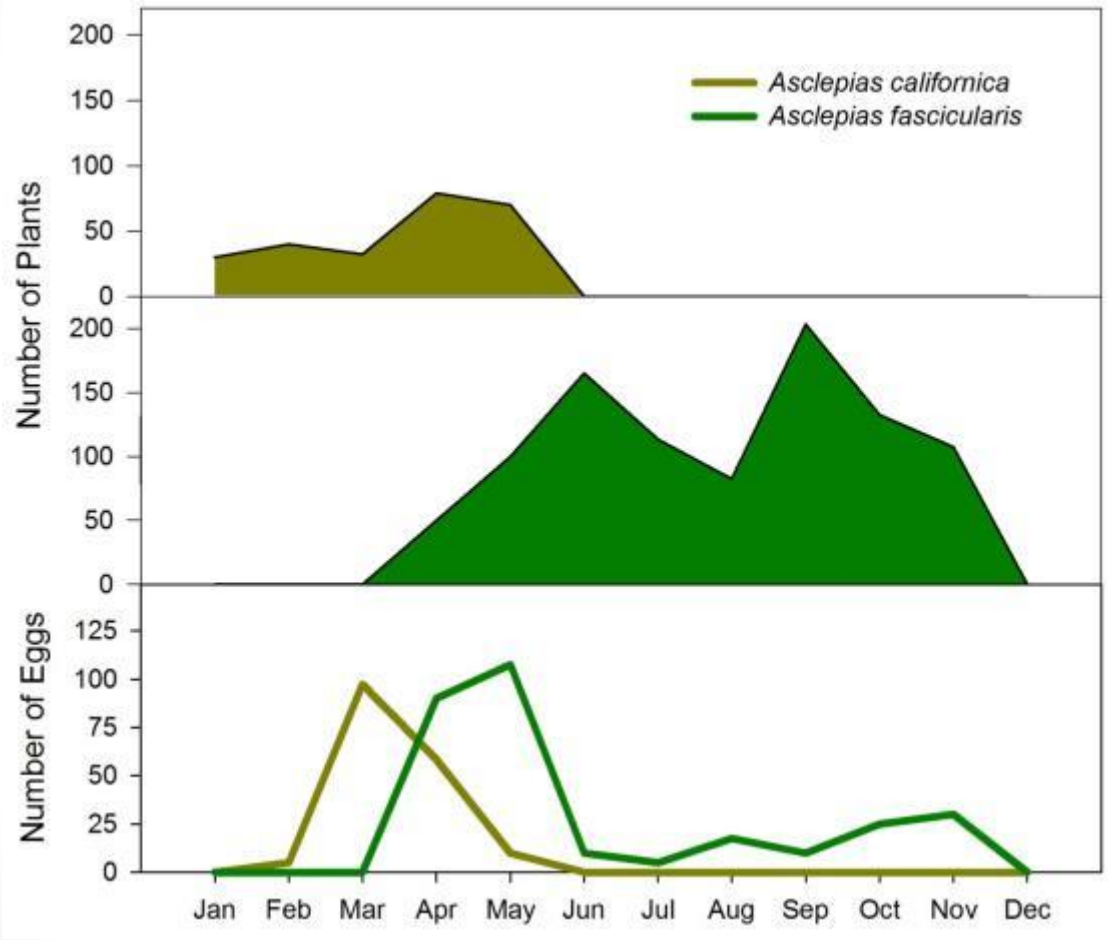


Tom Landis



Dingle et al. 2005

Phenology of Milkweeds



A. californica photo courtesy of Bobby Gendron. *A. fascicularis* photo by Tom Landis

Modified from Wenner and Harris (1993)

Forbs and Sage-Grouse

- **Sage-grouse Conservation Management Strategy**
  - Maintain forbs and grasses through grazing management
  - *Good for the bird is good for the herd*
- **BLM Secretarial Order 3336 - Fire Prevention Management Strategy**
  - Increase landscapes with sagebrush & perennial forbs/grasses

Forbs in Sage-Grouse Diet

- 18 to 50% of diet by weight of pre-nesting hens
  (Barnett and Crawford 1994)

- Chicks consume 34 genera of forbs (Drut et al. 1994)

Photo by Kas Dumroese

Photo by Jeremy Pinto

Forbs for Chicks

First 3 to 4 weeks

Annuals

- *Blepharipappus scaber*
- *Collinsia parviflora*
- *Collomia linearis*
- *Eriastrum sparsiflorum*
- *Gayophytum*
- *Linanthus*
- *Microsteris gracilis*

Perennials

- *Agoseris glauca*
- *Allium*
- *Antenarria*
- *Astragalus*
- *Castilleja*
- *Crepis*
- *Erigeron*
- *Fritillaria pudica*
- *Lepidium densiflorum*
- *Lomatium*
- *Lupinus*
- *Nothocalais troximoides*
- *Penstemon*
- *Phlox longifolia*
- *Trifolium*

Next 5 to 10 weeks

Perennials

- *Achillea millefolium*
- *Astragulus frigida*
- *Astragulus ludoviciana*
- *Calachortus*
- *Grindelia squarrosa*
- *Lupinus*
- *Orobanche fasiculata*
- *Symphyotrichum*

Late summer and fall

Perennials

- *Erigonum*
- *Symphyotrichum*

Klebenow and Gray 1968; Martin 1970; Peterson 1970; Wallestad et al. 1975; Barnett 1992; Barnett and Crawford 1994; Drut et al. 1994; Braun et al. 2005; Thompson et al. 2006; Ersch 2009; Greg and Crawford 2009; Rhodes 2010

Sage-grouse Eat Invertebrates that Like Forbs!

- 2100 insect species
- 60% of diet of chicks

Kas Dumroese

Forbs for Critters for Chicks

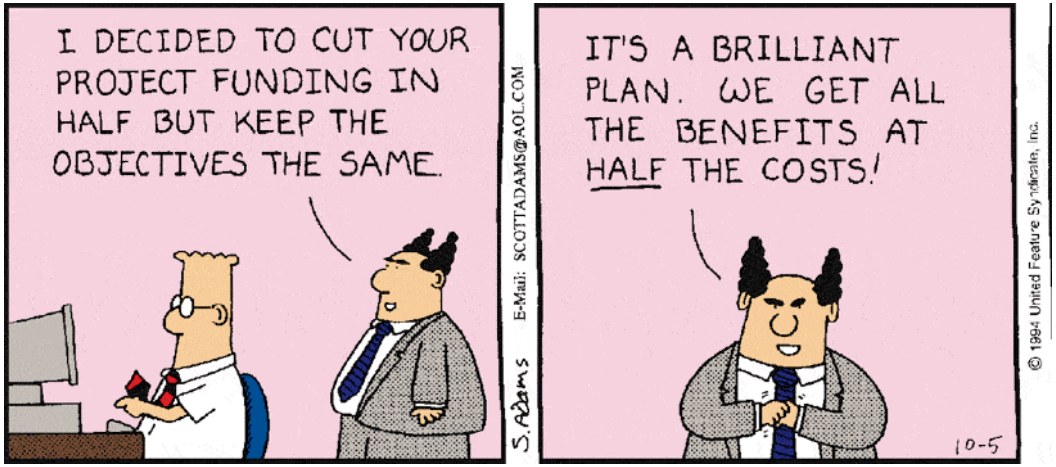
- Diverse forbs support diverse invertebrate community
- Invertebrates are protein-rich food sources
- Chicks consume 41 families of invertebrates (Drut et al. 1994)
  - Ants, beetles, grasshoppers, caterpillars

Photo by Jakob Shockey

- Availability of Lepidoptera larvae directly related to brood survival (Gregg and Crawford 2009)
  - *Ericameria* and *Chrysothamnus* communities yielded more caterpillars than *A. tridentata* ssp. *vaseyana* communities (Ersch 2009)

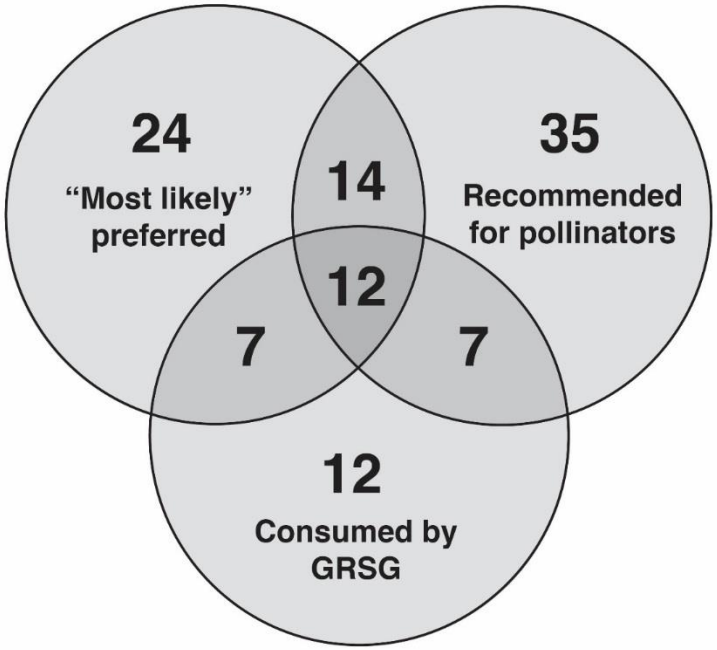
Too Much Funding?

- Didn't think so...
- Leverage resources to fulfill multiple conservation benefits



Forbs For All Three?

- "Most Likely" Preferred
  - Stiver et al. 2015
- Consumption assumptions
  - Dumroese et al. 2015 – NPJ
- Regional pollinator lists
  - Dumroese et al. 2016 - NAJ



Dumroese et al. 2016

The 12

- Milkvetch (*Astragalus*)
- Balsamroot (*Balsamorhiza*)
- Mariposa lily (*Calochortus*)
- Hawksbeard (*Crepis*)
- Fleabane (*Erigeron*)
- Buckwheat (*Eriogonum*)
- Avens (*Geum*)
- Desert parsley (*Lomatium*)
- Bluebells (*Mertensia*)
- Aster (*Symphyotrichum*)
- Clover (*Trifolium*)
- Vetch (*Vicia*)

How Many Forbs Are Needed?

- **Sage-grouse:** 10 genera on high-quality sites (Jacobs et al. 2013)
- **Pollinators:** frost to frost
- **Monarchs:** especially fall

Challenges with Forbs

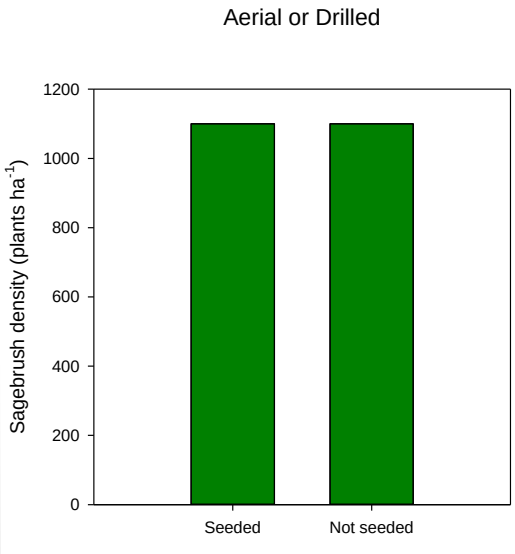
- Extremely important component of the sagebrush biome
  - Increases resilience and resistance to invasives
  - Critical for sage-grouse development
  - Impacts on pollinators, too
- Limited number of species commercially available
- Limited seed supply
  - Expensive

Challenges with Restoration

Alternative, complimentary methods for plant establishment

- *Don't put all your sage-grouse eggs in one basket*

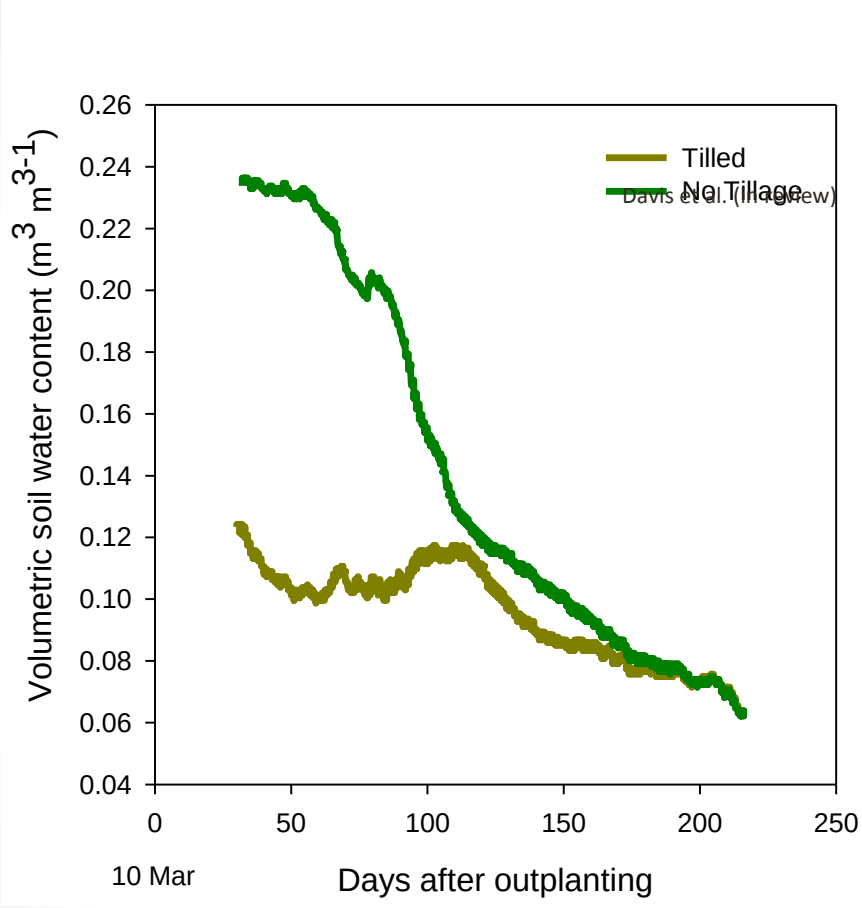
- Aerial seeding in lower elevation dryer areas often fails completely; similar mixed results with drilling.

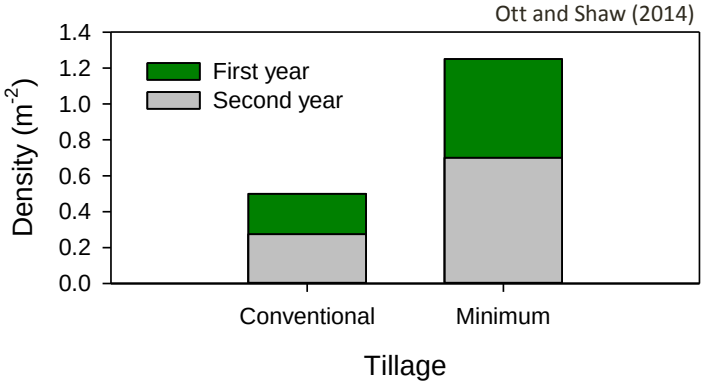


Knutson et al. (2014)

Photo from Finch and Tomosy (2014)

Soil Moisture





Palmer Drought Severity Index =
Mild deficit (-1.0 to -1.8)

Low-density Outplanting

- Outplanting seedlings across many acres
- Higher success of outplants for a similar dollar amount compared to aerial seeding
- Estimate: 100 sagebrush outplants per hectare = roughly \$42 ha^{-1} vs. aerial seeding = \$52 ha^{-1}
  - (40 ac^{-1}; \$17 ac^{-1} vs. \$21 ac^{-1})

Dettweiler-Robinson et al. (2013)

Target Plant Concept

- Project objectives
- Type of plant material
- Genetic considerations
- Limiting factors on site
- Timing of outplanting
- Outplanting tool / technique

Improve plant material quality and effectiveness of deployment to increase performance

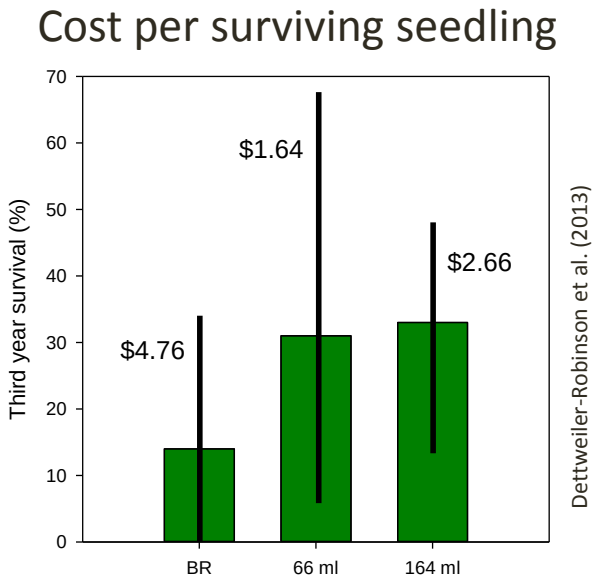
(Landis and Dumroese 2006)

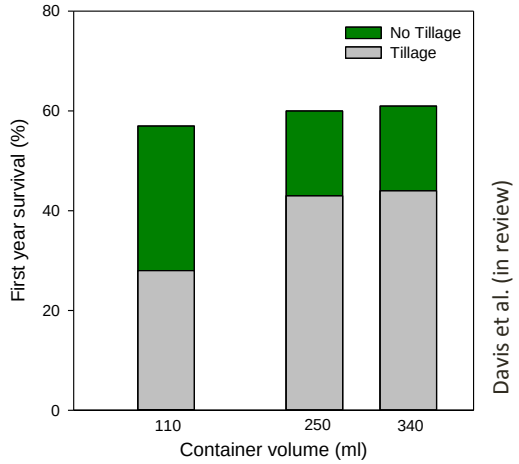
Outplanting Seedlings

Photo courtesy David Pyke

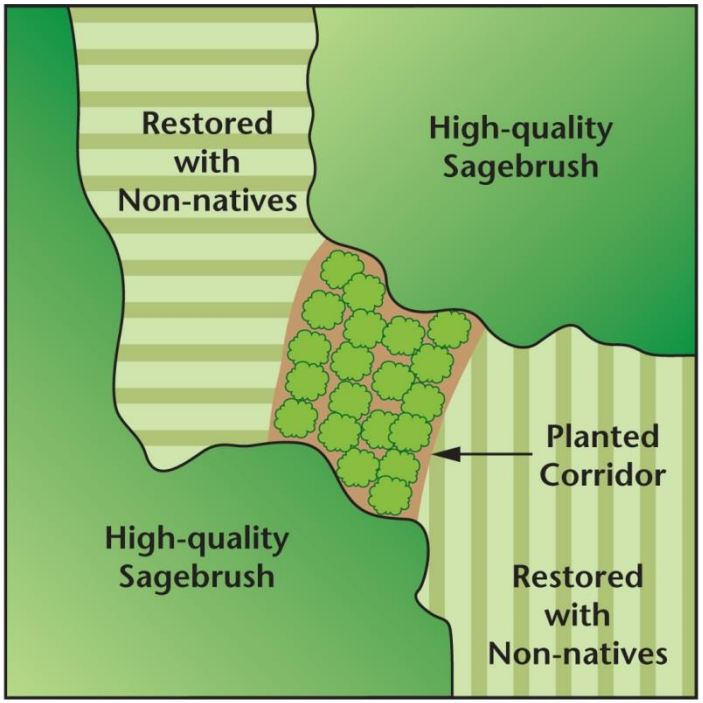
USFS Technology Development Center

Photo by Kas Dumroese

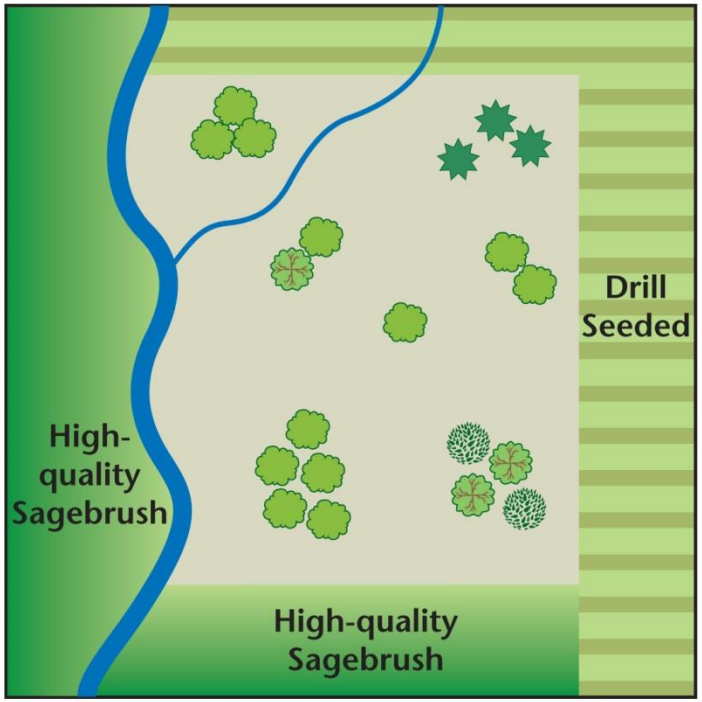




Landscape Applications



High-density corridor plantings to facilitate movement of sage-grouse and pollinators



Island (clump) or nucleation plantings to augment species diversity – could be single or multiple species

From Stanturf et al. (2014)

Considering Climate Change

- Provisional seed zones are the starting point

Bower et al. (2014)

Considering Climate Change

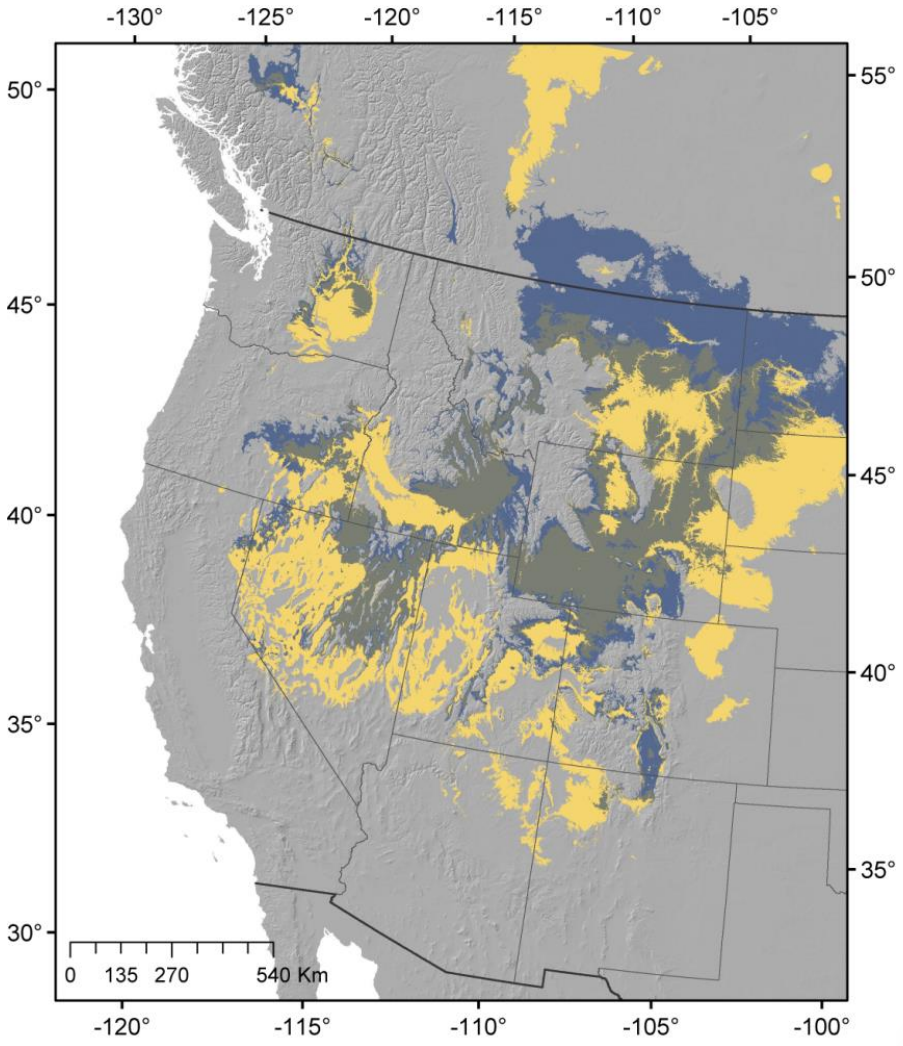
Bioclimatic models suggest future range of Wyoming big sagebrush in 2060

Blue = expanding

Gray = stable

Yellow = contracting

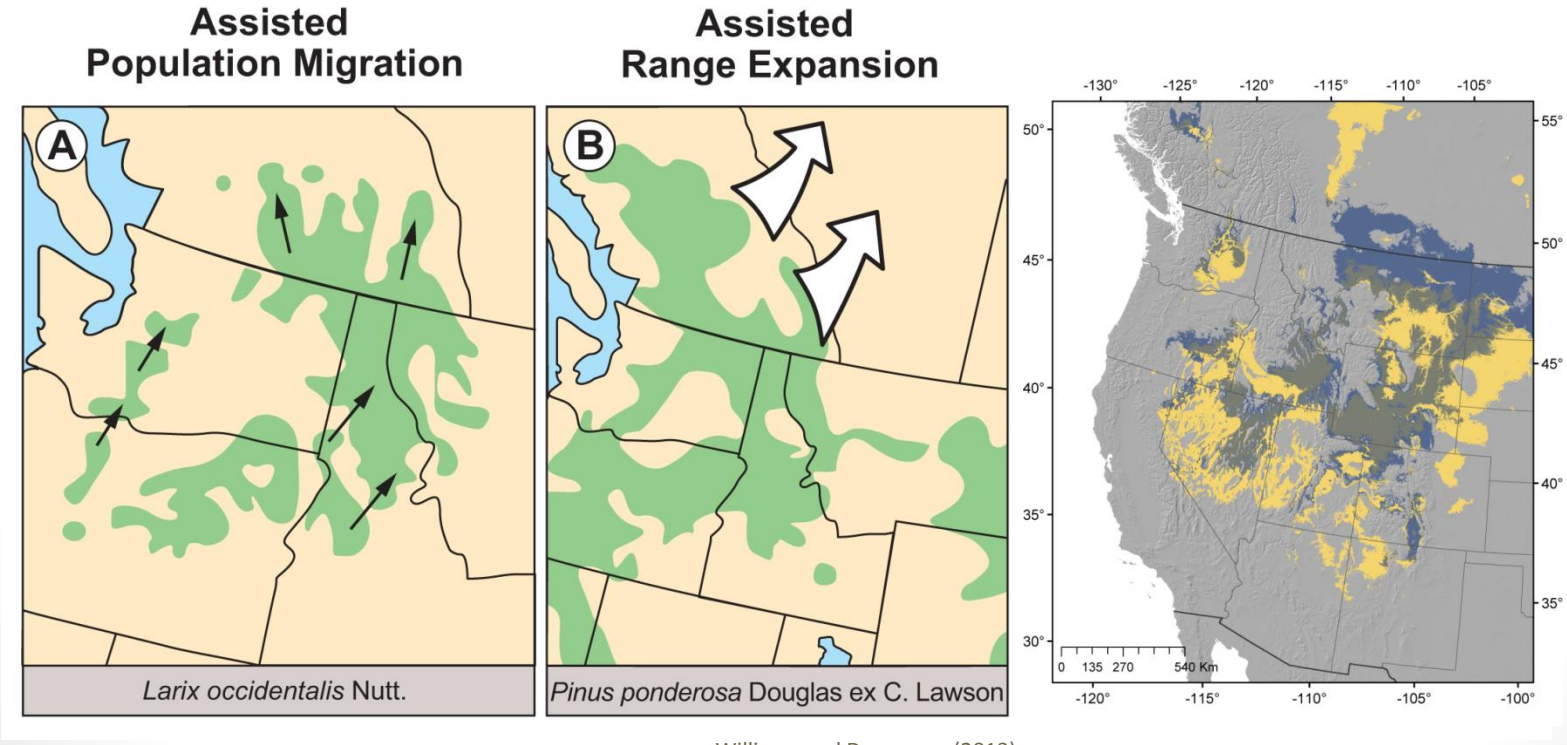
(Purely climate-based. Soils and other environmental factors can affect distribution.)



Still and Richardson (2015)

Considering Climate Change

Developing guidelines for dynamic use of seed zones and assisted migration



Williams and Dumroese (2013)

Summary

Kill 6 birds (but not sage-grouse!) with one stone?

- **Focus on forbs** (annuals and perennials)...
  1. Improve sagebrush ecosystem resilience
     - Invasive species
     - Fire
     - Climate
  2. Direct support of sage-grouse (food source)
  3. Indirect support of sage-grouse (invertebrate support)
  4. Support pollinators
  5. Support monarch butterflies
  6. Biodiversity

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Photo Jeremy Pinto

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Photo Jeremy Pinto

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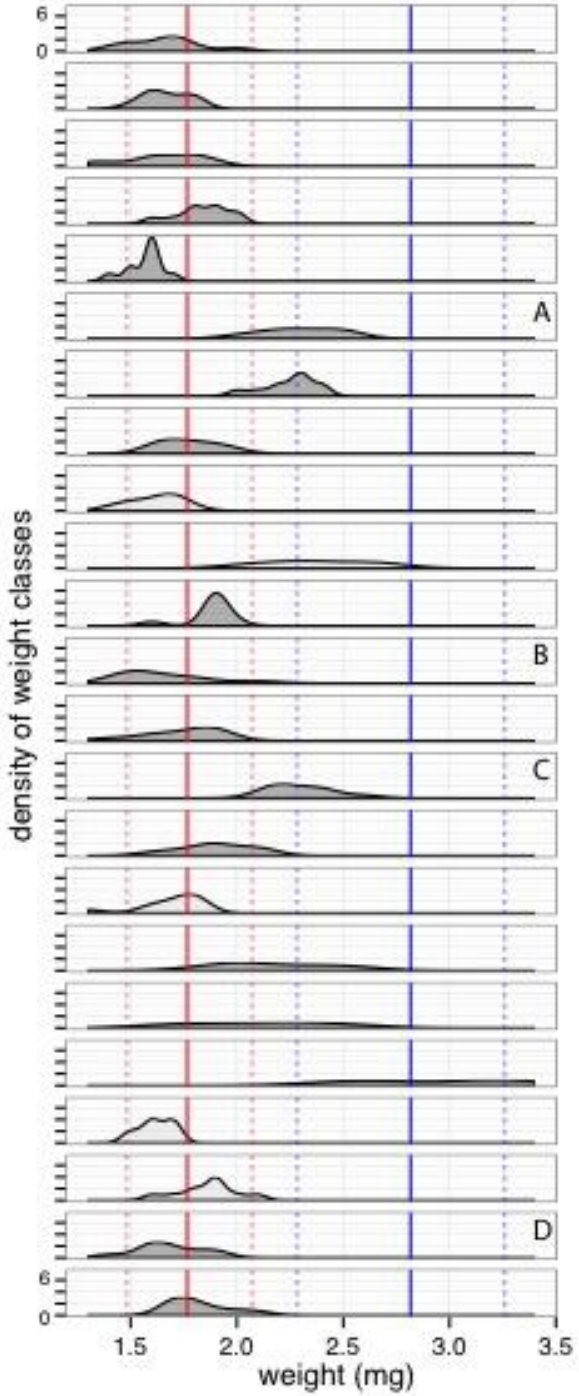
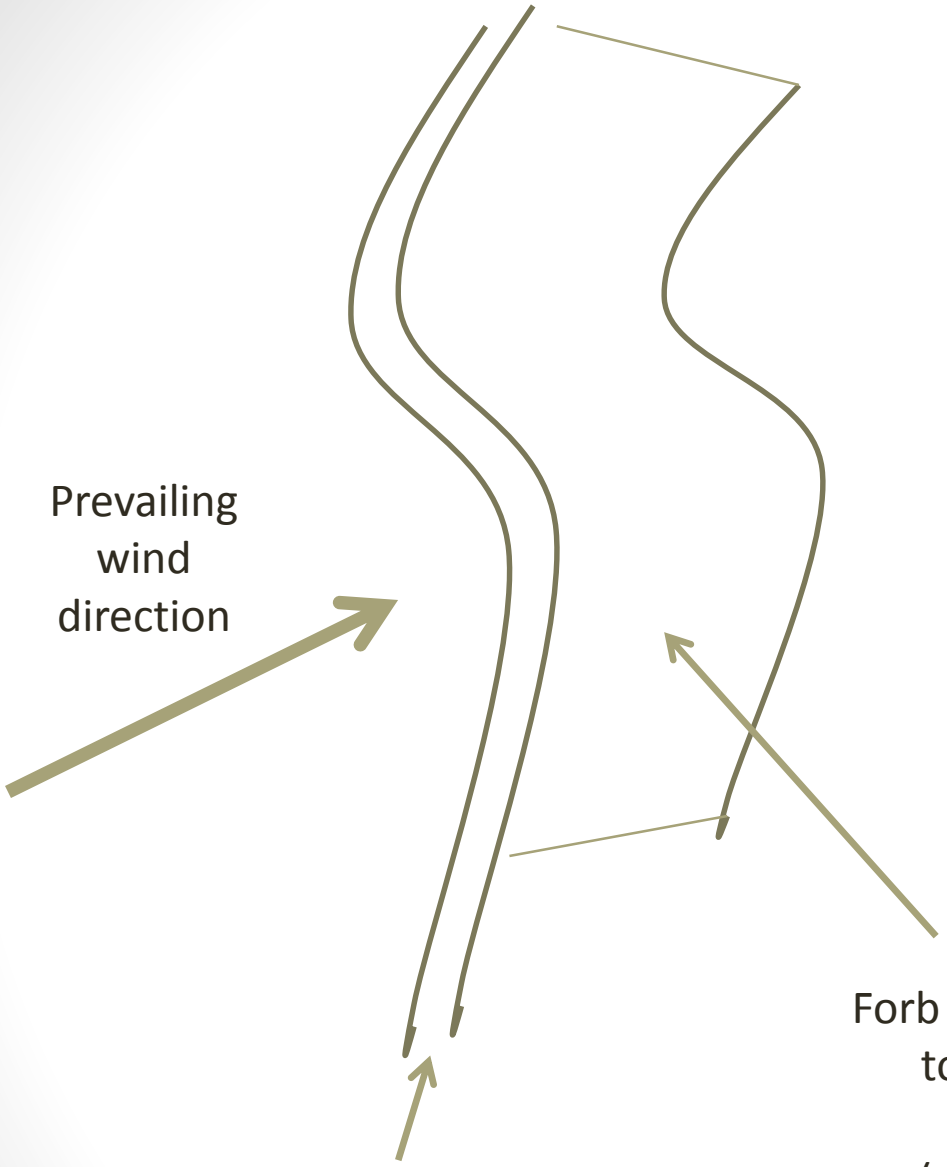
Seed weight as a diagnostic for subspecies of big sagebrush

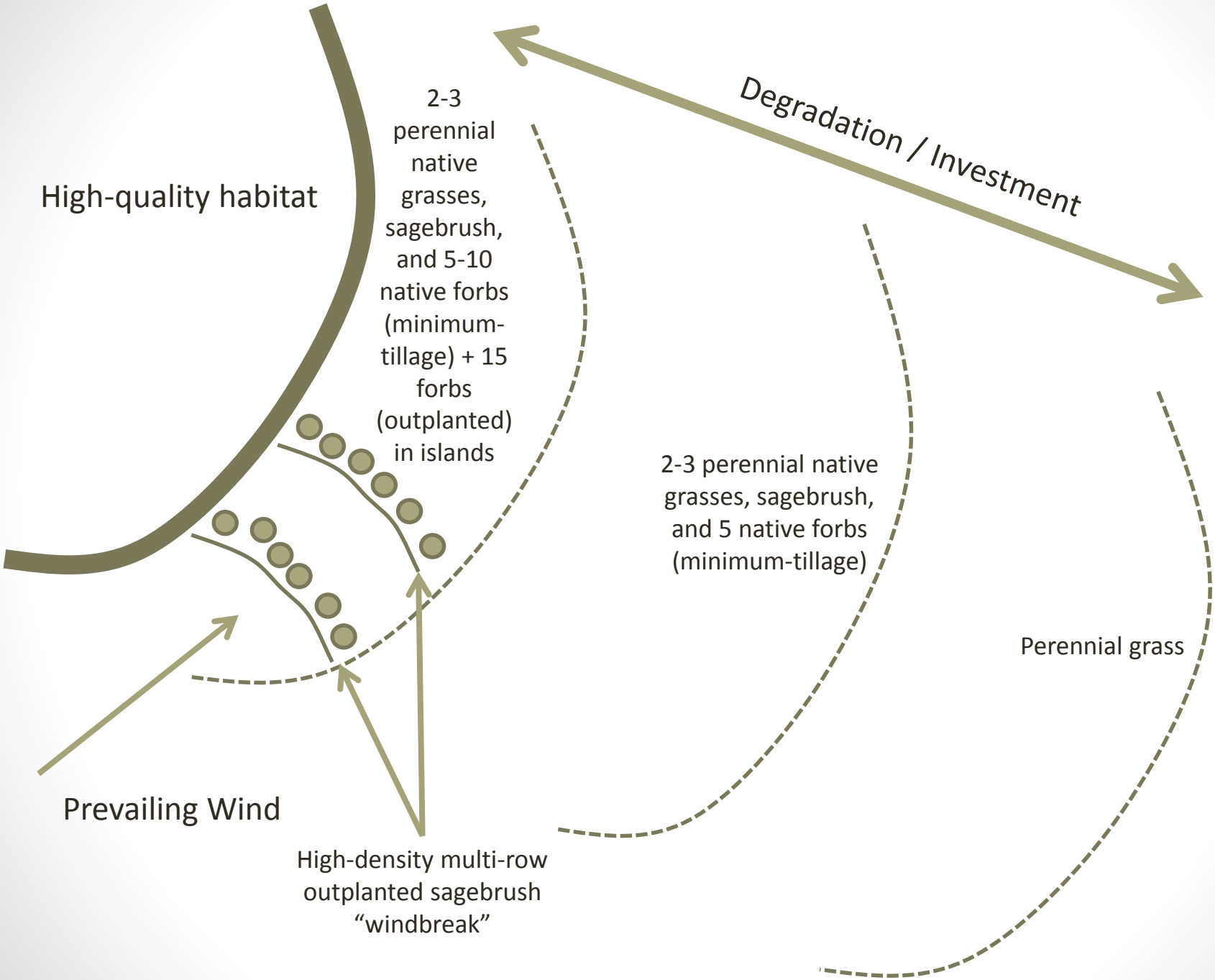
Distribution of 10-seed-weights for BLM purchased seed lots for 2013 and 2014.

Only 17% of seedlots labeled as Wyoming big sagebrush met the confidence intervals for weights based on experimental collections. The remaining 83% match basin big sagebrush.

The BLM is getting Basin big sagebrush seed when they are asking for Wyoming.




Prevailing
wind
direction
High-density, multi-row,
outplanted sagebrush
“windbreak”
Forb “island” on lee side of windbreak
to take advantage of additional
moisture from drifted snow
(seeds or outplanted seedlings)


Degradation / Investment
High-quality habitat
2-3 perennial native grasses, sagebrush, and 5-10 native forbs (minimum-tillage) + 15 forbs (outplanted) in islands
2-3 perennial native grasses, sagebrush, and 5 native forbs (minimum-tillage)
Perennial grass
Prevailing Wind
High-density multi-row outplanted sagebrush "windbreak"

Nursery-grown mini-plugs for seed increase bed establishment

Munro's Globemallow

Direct Seeding

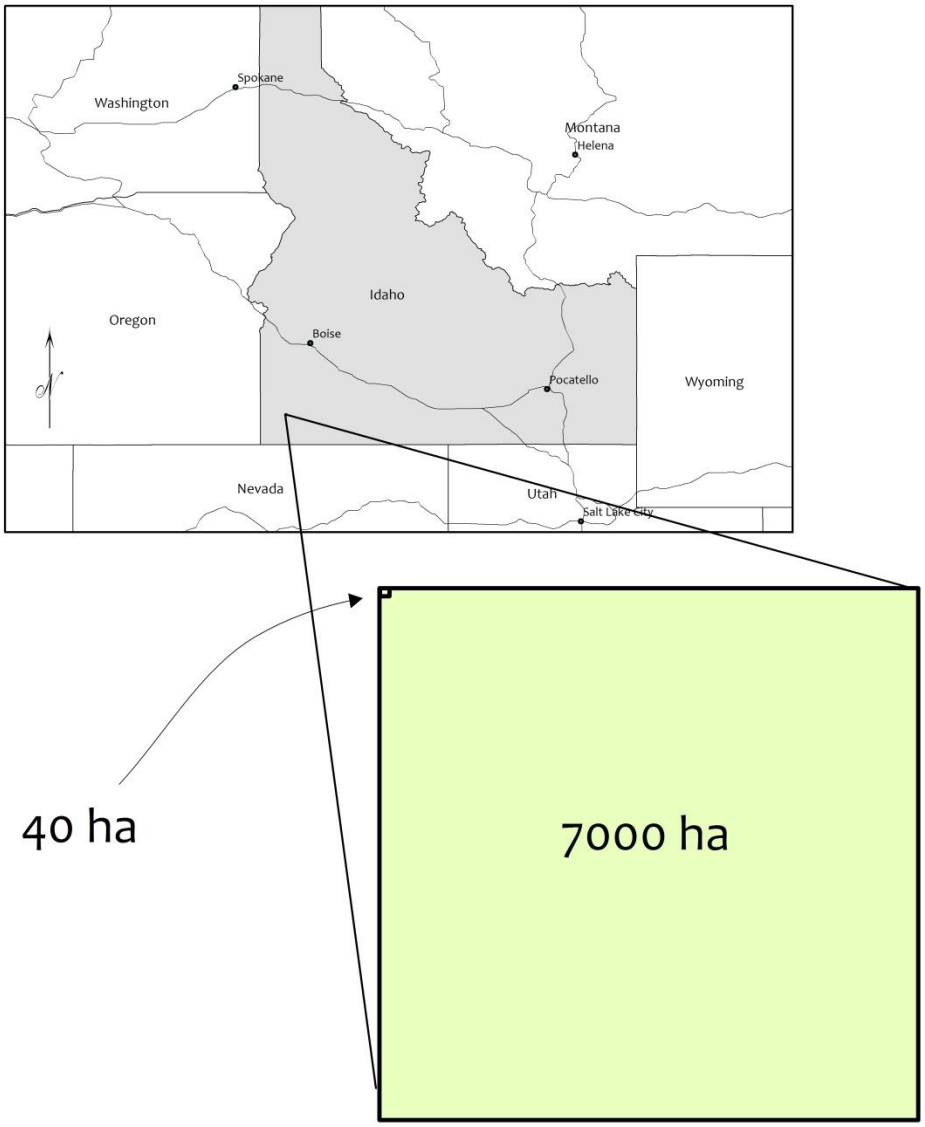
- 40 ha (100 ac)
- 1.6 kg PLS ha^{-1} desired
- 110 seeds m^{-2}*
- 44 million seeds
- 143000 seeds kg^{-2}** (317,000 lb^{-1})
- 305 kg seeds needed
- \$57 kg^{-1}* (\$90 lb^{-1})
- \$12055 seed cost

Outplanting Seedlings

- 40 ha (100 ac)
- 1000 ha^{-1} desired
- 3 seeds per container
- 275000 seeds
- 143000 seeds kg^{-2}
- 1.9 kg seeds needed
- \$57 kg^{-1}*
- \$108 seed cost

Saved enough seeds to grow another 14 million plants (7000 ha)

*Granite Seed and Erosion Control, Lehi, Utah (pers comm and website: 6 Apr 2015)
** Data from US Forest Service Bend Pine Seed Extractory (7 Apr 2015; Herriman))


Washington
Spokane
Montana
Helena
Idaho
Oregon
Boise
Pocatello
Wyoming
Nevada
Utah
Salt Lake City
40 ha
7000 ha