A new moble app off-line use of provisional seed zones for native plants

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Photo: D. Steinfeld

Why are Seed Zones important?

- Use of appropriate plant materials is a core component of successful restoration projects

- The key to identifying appropriate plant materials (e.g. seeds) lies in understanding the genetics of adaptation

Species	Source	Principals*	Current Status
Blue wildrye (*Elymus glaucus* Buckley)	e. OR, n. CA	R6, PNWRS	*Erickson et al. 2004*
Broadleaf lupine (*Lupinus latifolius* Lindl. ex J. Agardh)) (Fabaceae)	w. OR, WA	R6	*Doede 2005*
Oceanspray (*Holodiscus discolor* (Pursh) Maxim.)(Rosaceae)	w.OR, WA	NRCS, PNWRS	*Horning et al. 2008*
Roemer's fescue (*Festuca idahoensis* Elmer ssp. Roemeri (Pavlick) S. Aiken)	w. OR, WA	NRCS, PNWRS	*Wilson et al. 2008*
Mountain brome (*Bromus marginatus* Nees exSteud.)	e. Or	R6, ARS	*Johnson et al. 2010b*
Bigleaf lupine (*Lupinus polyphyllus* var. *polyphyllus*	w. OR	IAE, NRCS	*Miller et al. 2011*
Wooly sunflower (*Eriophyllum lanatum* var. *leucophyllum*)	w. OR	IAE, NRCS	*Miller et al. 2011*
Denseflower willowherb (*Epilobium densiflorum*)	w. OR	IAE, NRCS	*Miller et al. 2011*
Slender cinquefoil (*Potentilla gracilis* var. *gracilis*)	w. OR	IAE, NRCS	*Miller et al. 2011*
Oregon saxifrage (*Saxifraga oregano*)	w. OR	IAE, NRCS	*Miller et al. 2011*
Indian ricegrass (*Acnatherum hymenoides*)		ARS	*Johnson et al. 2012*
California brome (*Bromus carinatus* Hook & Arn,)	e. Or, w. Or, n. Ca	R6	Complete Internal report
Big Deer Vetch (*Lotus crassifolius*)	OR	R6	Complete Internal report
Bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh) A. Löve)	OR, WA, ID, NV, CA	PNWRS, ARS, RMRS	Complete *Submitted for publication*
Taper-tip onion (*Allium acuminatum*)	OR, ID, NV	ARS	Complete
Antelope bitterbrush (*Purshia tridentata* (Pursh) DC.)	e. OR, WA	PNWRS	Data collection complete
Blackbrush (*Coleogyne ramosissima*)	CA, NV, UT, n. AZ	RMRS	Data collection complete
Sulphur-flower buckwheat (*Eriogonum umbellatum)*	s. ID, se. OR	RMRS	Data collection complete
Fernleaf biscuitroot (*Lomatium dissectum* (Nutt.) Mathias & Constance)(Apiaceae)	s. ID, se. OR	PNWRS, RMRS	Data collection complete
Sanderg's bluegrass (*Poa secunda* J. Presl)	OR, WA, ID, NV, CA	PNWRS, ARS, RMRS	Data collection complete
Prairie Junegrass (*Koeleria macrantha* (Ledeb.) Schult.)	OR, WA, ID, NV, CA	PNWRS, PNW, NRCS	Data collection complete
Big sagebrush (*Artemisia tridentata*)	rangewide	RMRS	Data collection in progress
Bottlebrush squirreltail (*Elymus elymoides* (Raf.) Swezey)	OR, WA	PNWRS	Planted 2012

What about all the OTHER species that we don’t have this info for?

Communications

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Generalized provisional seed zones for native plants

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Abstract. Deploying well-adapted and ecologically appropriate plant materials is a core component of successful restoration projects. We have developed generalized provisional seed zones that can be applied to any plant species in the United States to help guide seed movement. These seed zones are based on the intersection of high-resolution climatic data for winter minimum temperature and aridity (as measured by annual heat : moisture index), each classified into discrete bands. This results in the delineation of 64 provisional seed zones for the continental United States. These zones represent areas of relative climatic similarity, and movement of seed within these zones should help to minimize maladaptation. Superimposing Omernik's level III ecoregions over these seed zones distinguishes areas that are similar climatically yet different ecologically. A quantitative comparison of provisional seed zones with level III ecoregions and provisional seed zones within ecoregions for three species showed that provisional seed zone within ecoregion often explained the greatest proportion of variation in a suite of traits potentially related to plant fitness. These provisional seed zones can be considered a starting point for guidelines for seed transfer, and should be utilized in conjunction with appropriate species-specific information as well as local knowledge of microsite differences.

Key words: adaptive traits; aridity; ecoregion; genetic variation; local adaptation; native plants; precipitation; restoration; seed transfer guideline; seed zone; temperature.

Introduction

The use of native plant species in ecological restoration has become increasingly prevalent in the United States, particularly on western federal lands, and is expected to increase in the future due to challenges such as climate change, severe wildfires, invasive plants, and declining populations of at-risk species (USDA Forest Service 2012*a*). The introduction of novel and potentially maladapted genotypes is a major concern in restoration. Nonlocal genotypes may reduce the success of restoration projects if they are maladapted, and could negatively affect adjacent native populations adapted to local environmental conditions through gene flow (McKay et al. 2005). Restoration with native plants is still relatively new in the western United States and the supporting research, infrastructure and plant material development programs are all in early stages of development (Erickson 2008, Johnson et al. 2010*a*, USDA Forest Service 2012*b*). Several United States federal and state agencies either suggest or require the use of locally adapted and regionally appropriate native plant materials based on site characteristics and ecological setting (see Appendix 1 in Johnson et al. 2010*a*). This means that plant germplasm should be adapted to current environments, yet also possess sufficient diversity to adapt and respond to ever-changing biotic and abiotic conditions. However, sufficient information on plant responses to key environmental gradients such as temperature and precipitation is lacking for the vast majority of native grasses, forbs, and shrubs used in restoration.

Results from genetic studies of forest trees show that adaptive variation is often associated with seasonal temperature and moisture regimes of the source environment (e.g., temperature, precipitation, number of frost free days, drought indices, etc. [Aitken et al. 2008, Chimura et al. 2011]). Patterns of genetic variation vary greatly among species. Some are climatic specialists that exhibit strong differentiation over small geographic scales, and thus, should not be moved far into different

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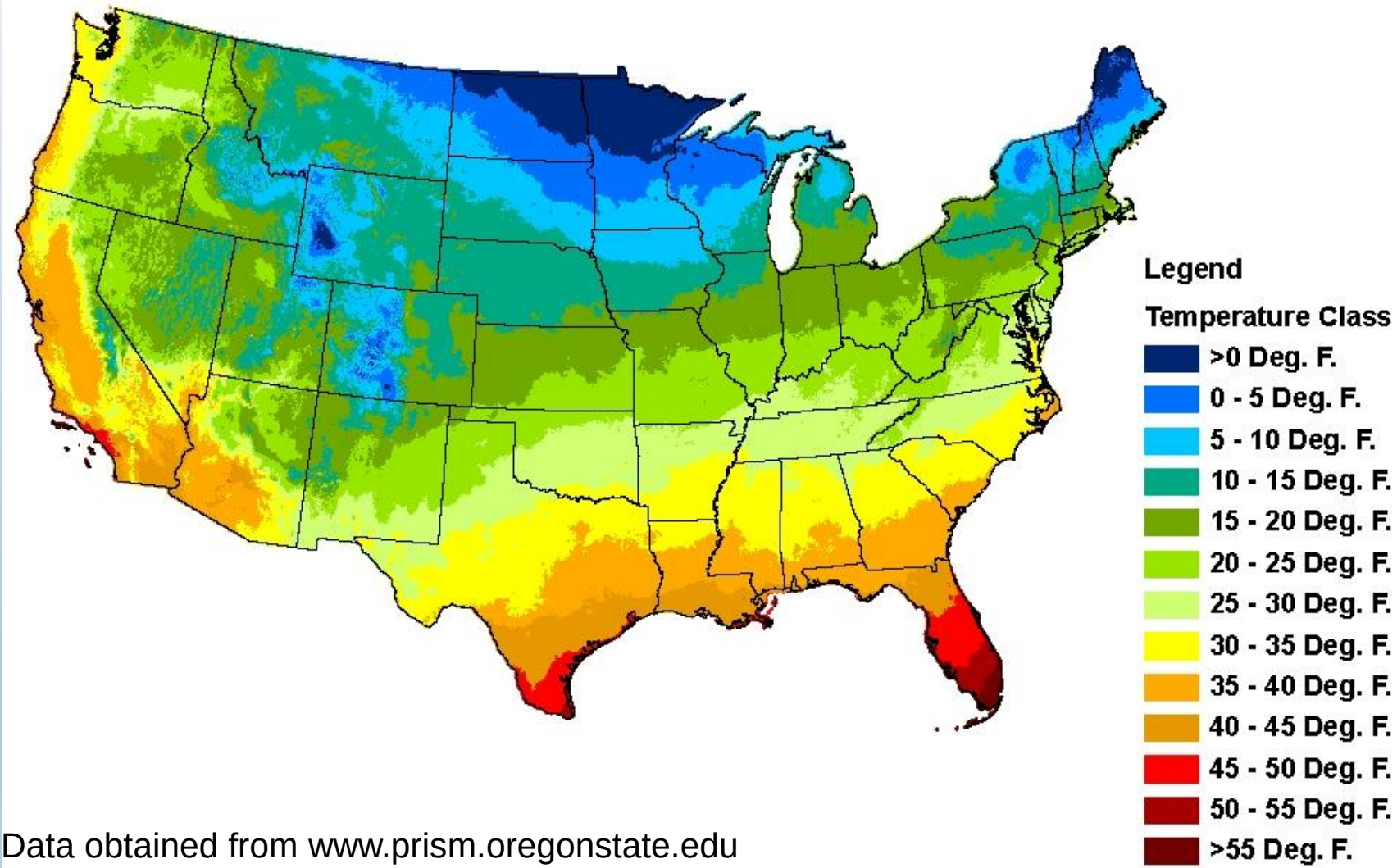
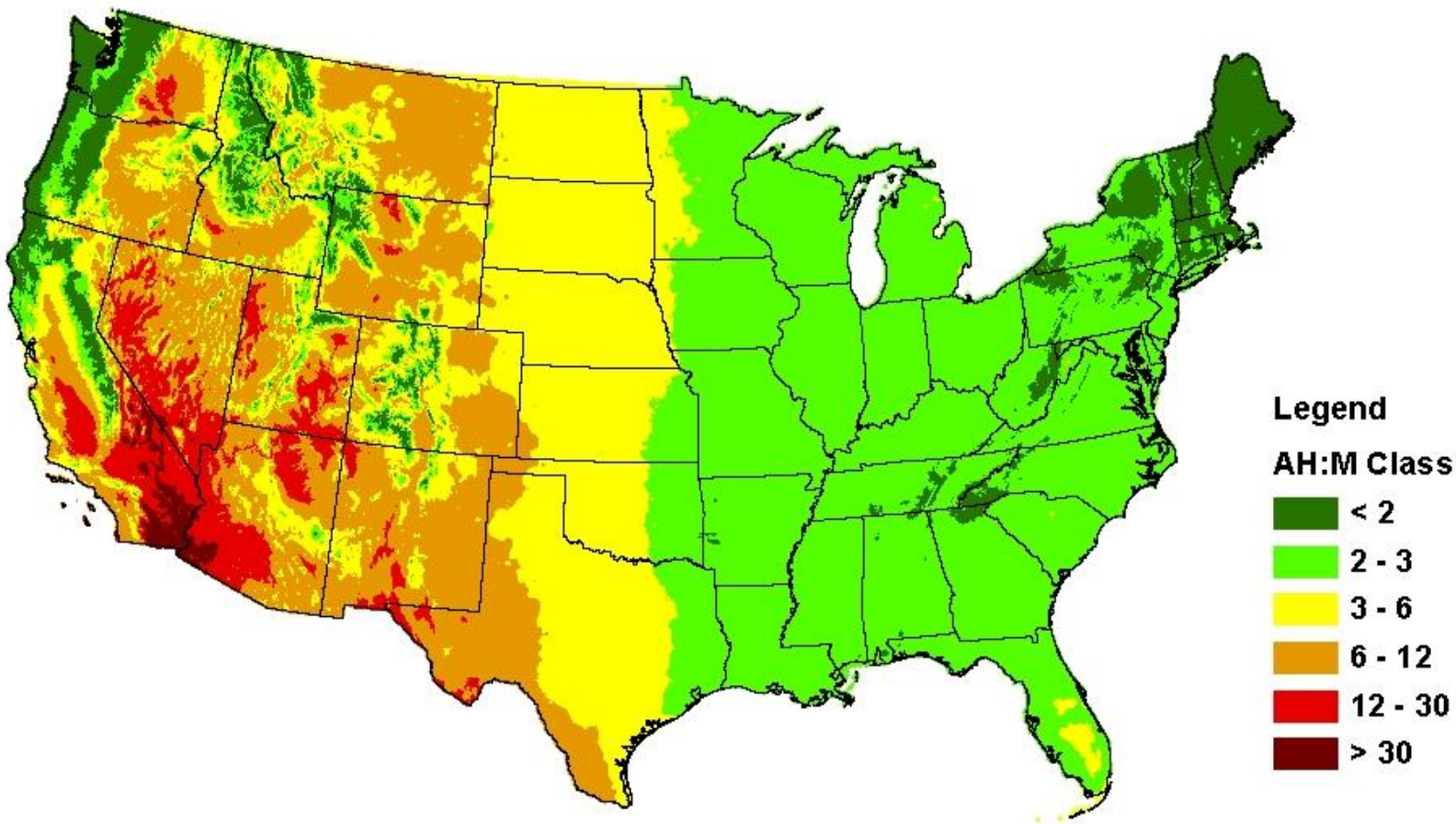
Avg Min. Temp. 5º F Bands



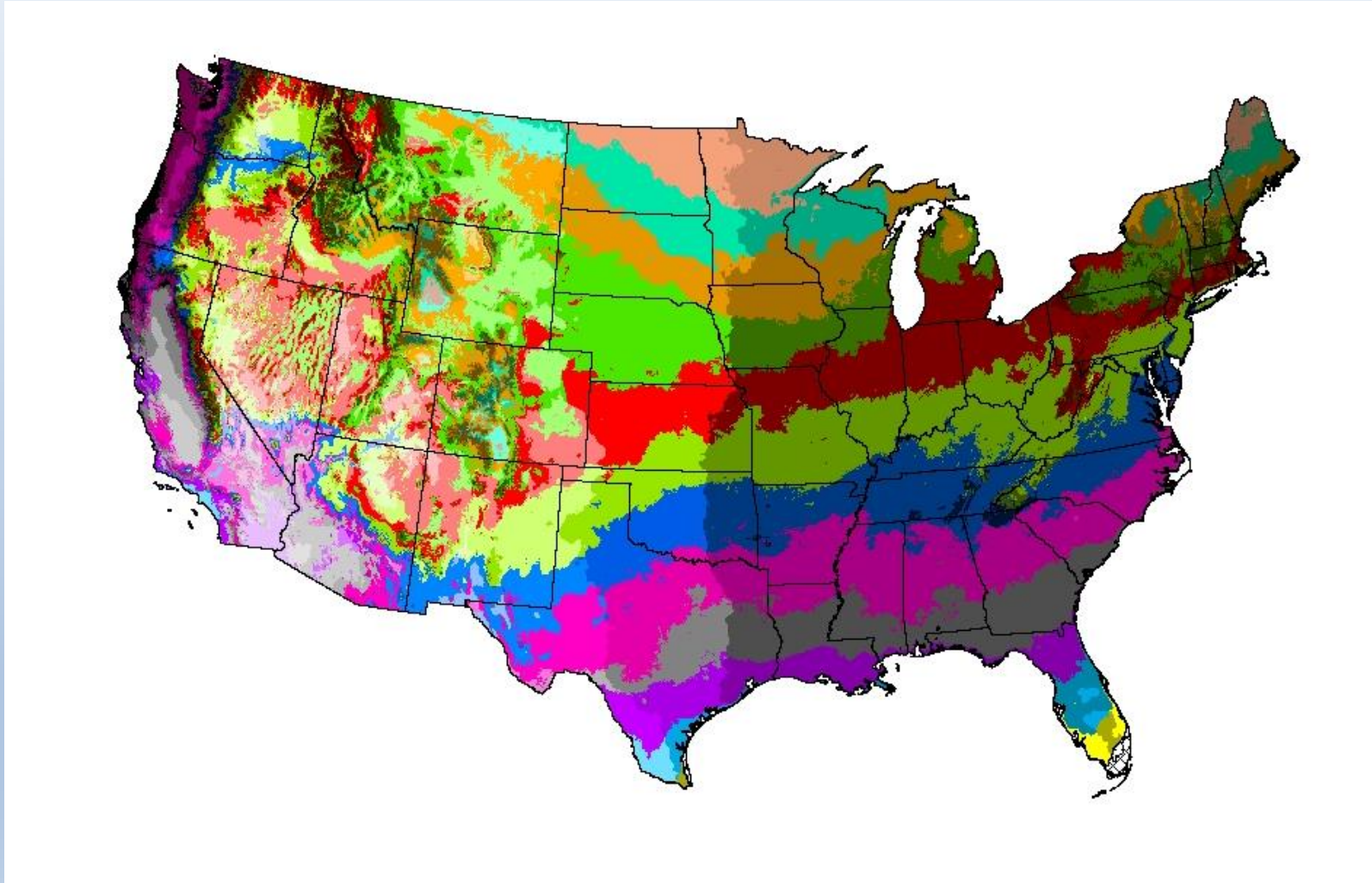
Data obtained from www.prism.oregonstate.edu

Annual Heat:Moisture Index (6 bands)

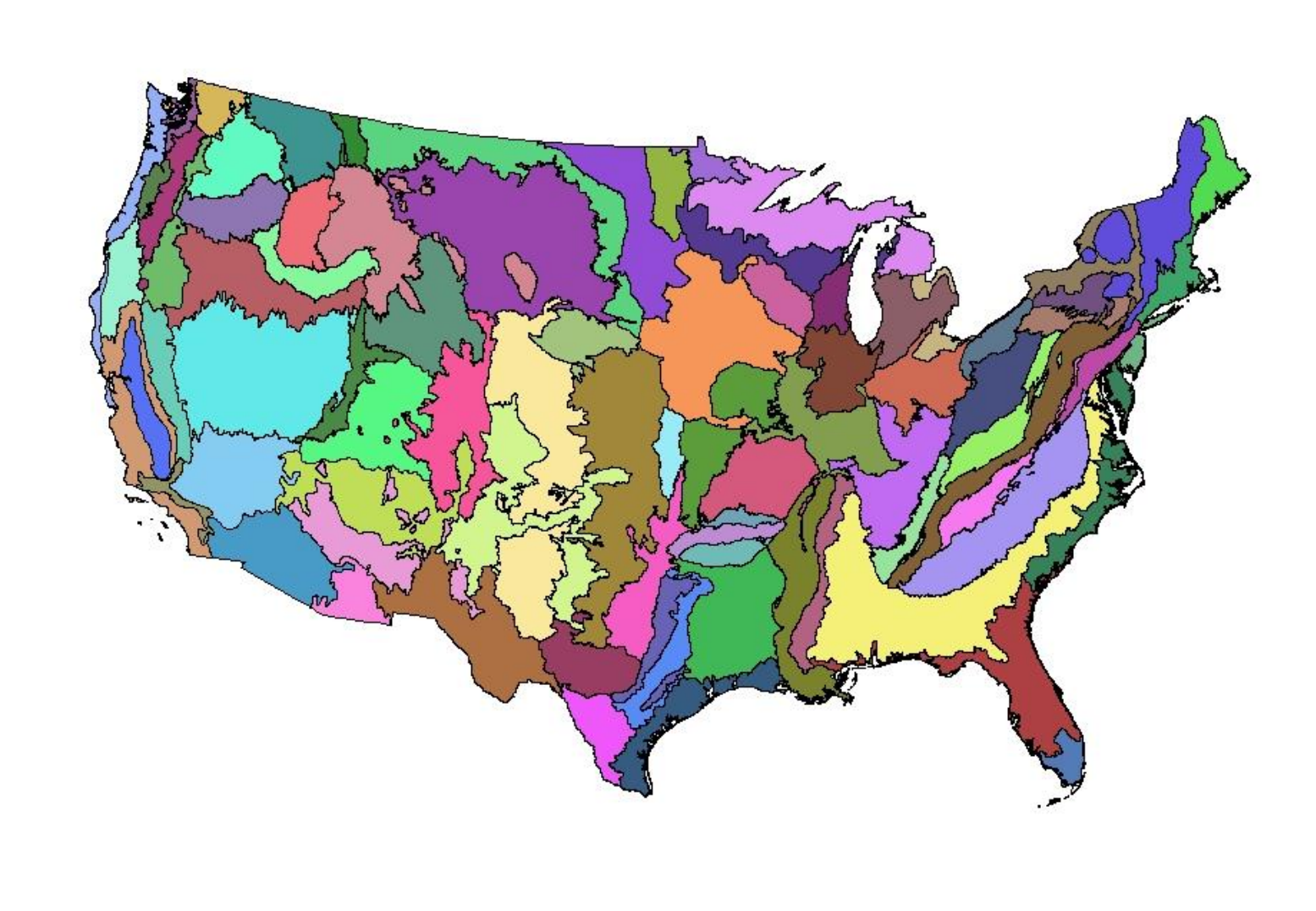


Data obtained from www.prism.oregonstate.edu

Climate Based Provisional Seed Zones

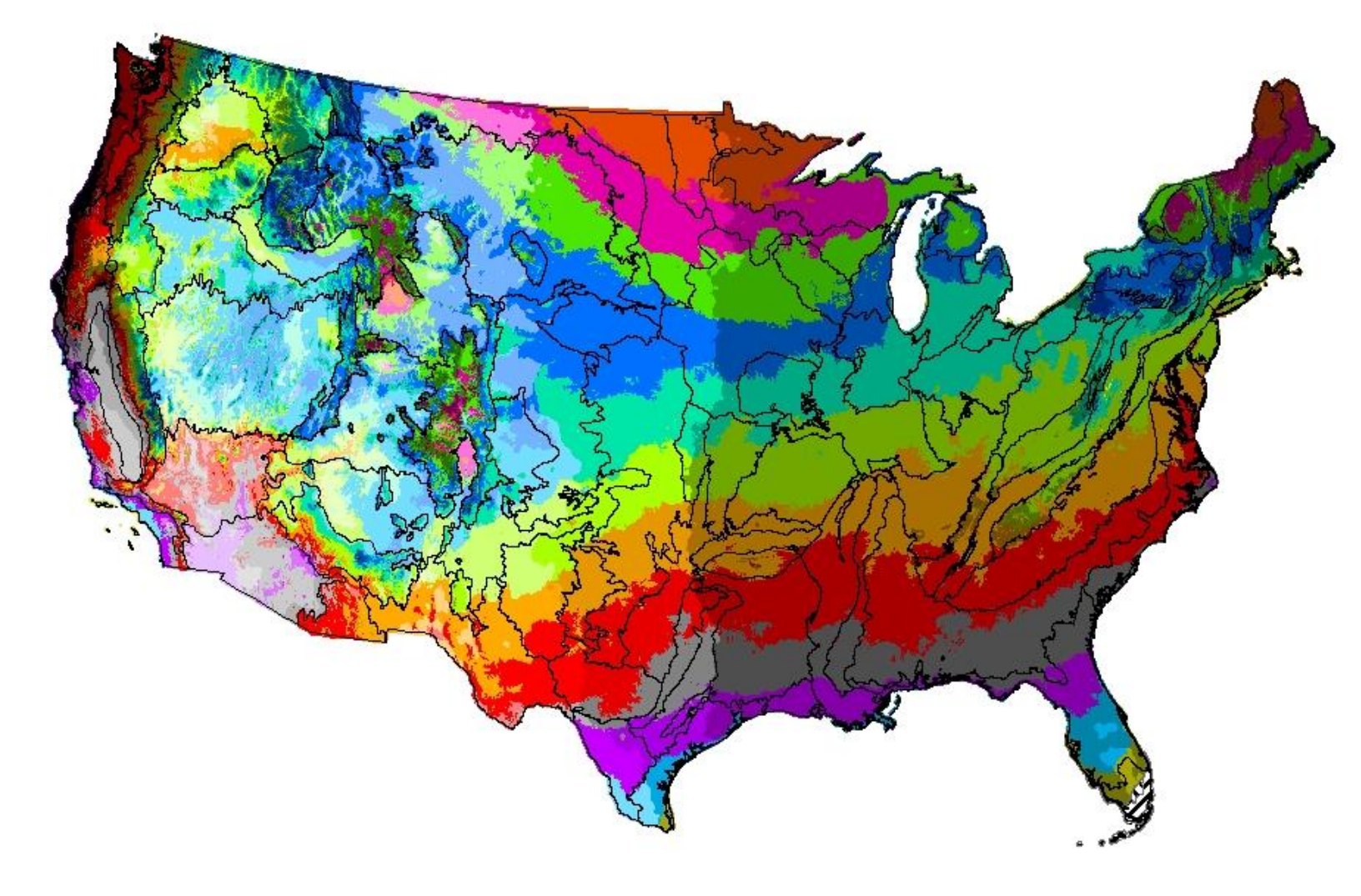


Omernick's Level III Ecoregions



http://www.epa.gov/naaujydh/pages/ecoregions/level_iii.htm

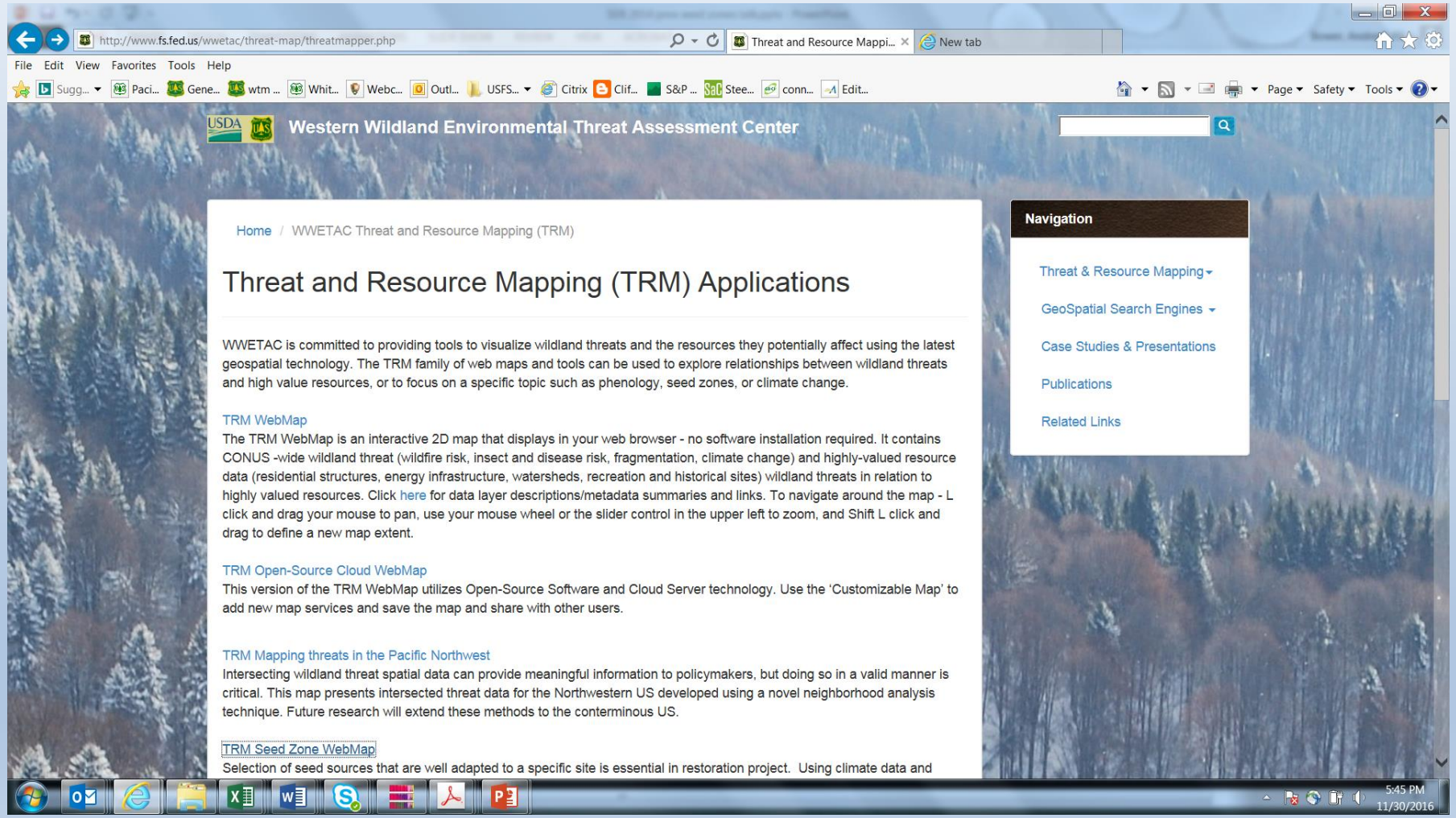
Seed Zones + Level III Ecoregions



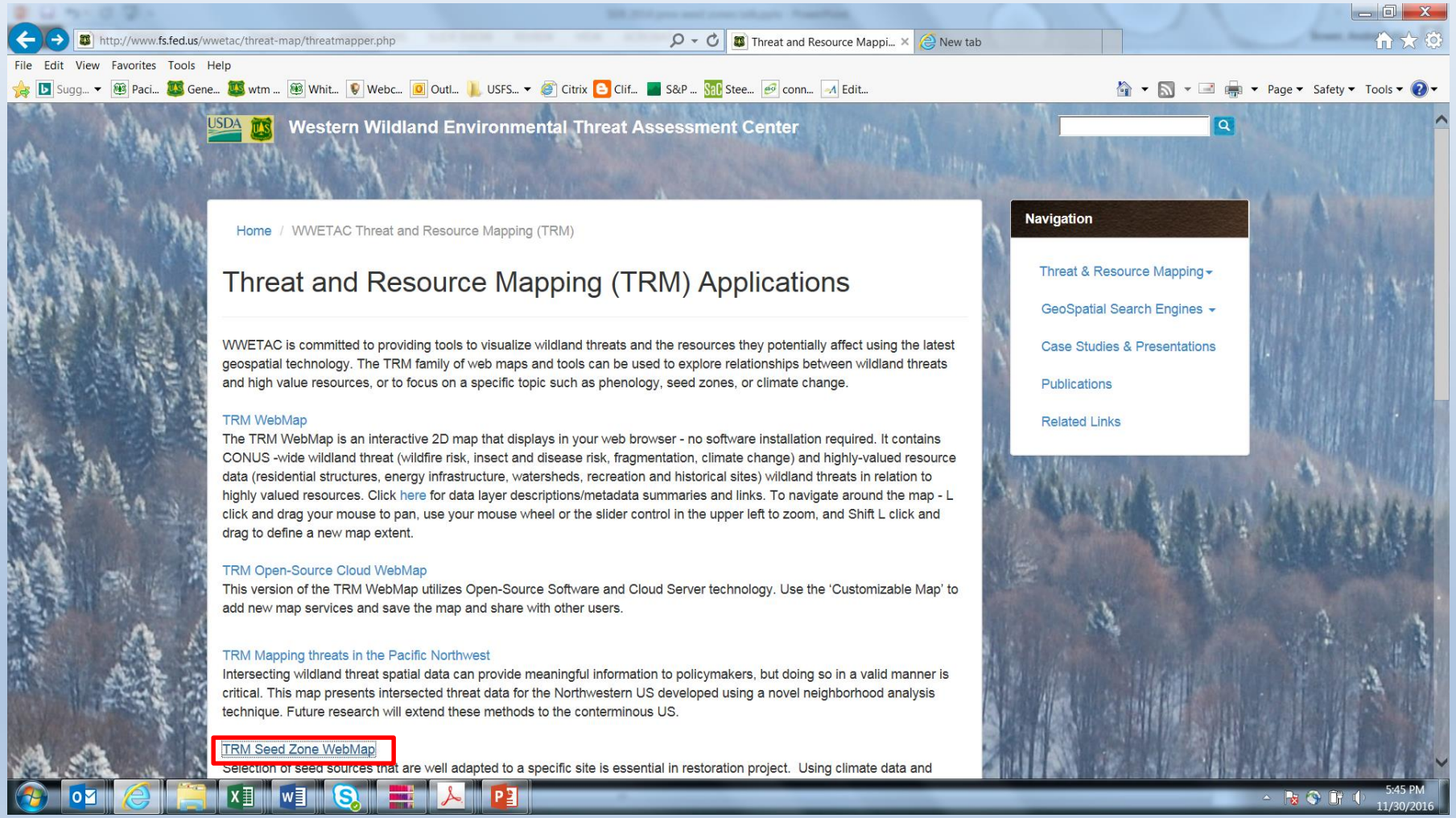
Building Provisional Seed Zones

- Independent of genetics
  - Intended for species with no specific genetic data available
- Provisional seed zones are a “starting point”
- Local and species specific knowledge important in adjusting zones for use

Seed Zone Mapper



Seed Zone Mapper



Seed Zone Applications

http://www.fs.fed.us/wwetac/threat-map/TRMSeedZoneMapper.php

WWETAC TRM Seed Zone ... | Prov. Seed Zone Map | New tab

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TRM Seed Zone Applications

SEED ZONE = an area within which plant materials can be transferred with little risk of being poorly adapted to their new location.

Click here to go to the Seed Zone data page.

This site allows end-users to view and acquire data on seed zones for use in plant material development, gene conservation and native plant restoration activities. Users can also evaluate seed zones in relation to other map services and wildland threats published by WWETAC such as climate change projections or wildfire risk.

TRM Seed Zone WebMap

The Seed Zone WebMap is an interactive 2D map that displays in your internet web browser - no software installation is required. To navigate around the map, Left-click and drag your mouse to pan, use your mouse wheel or the slider control in the upper left to zoom, and Shift-Left click to drag to define a new map extent. Click on the 'Tools' pane on the right side to access tools such as zoom to layer, zoom to a user-defined point, and identify.

Mobile Seed Zone Mapping

Mobile mapping applications for Andorid and iOS devices have been developed to bring seed zones out into the field. Click the above link to learn more.

Seed Zone Map Layers

Deploying well adapted and ecologically appropriate plant materials is a core component of a successful restoration project. However,

Navigation

- Threat & Resource Mapping
- GeoSpatial Search Engines
- Case Studies & Presentations
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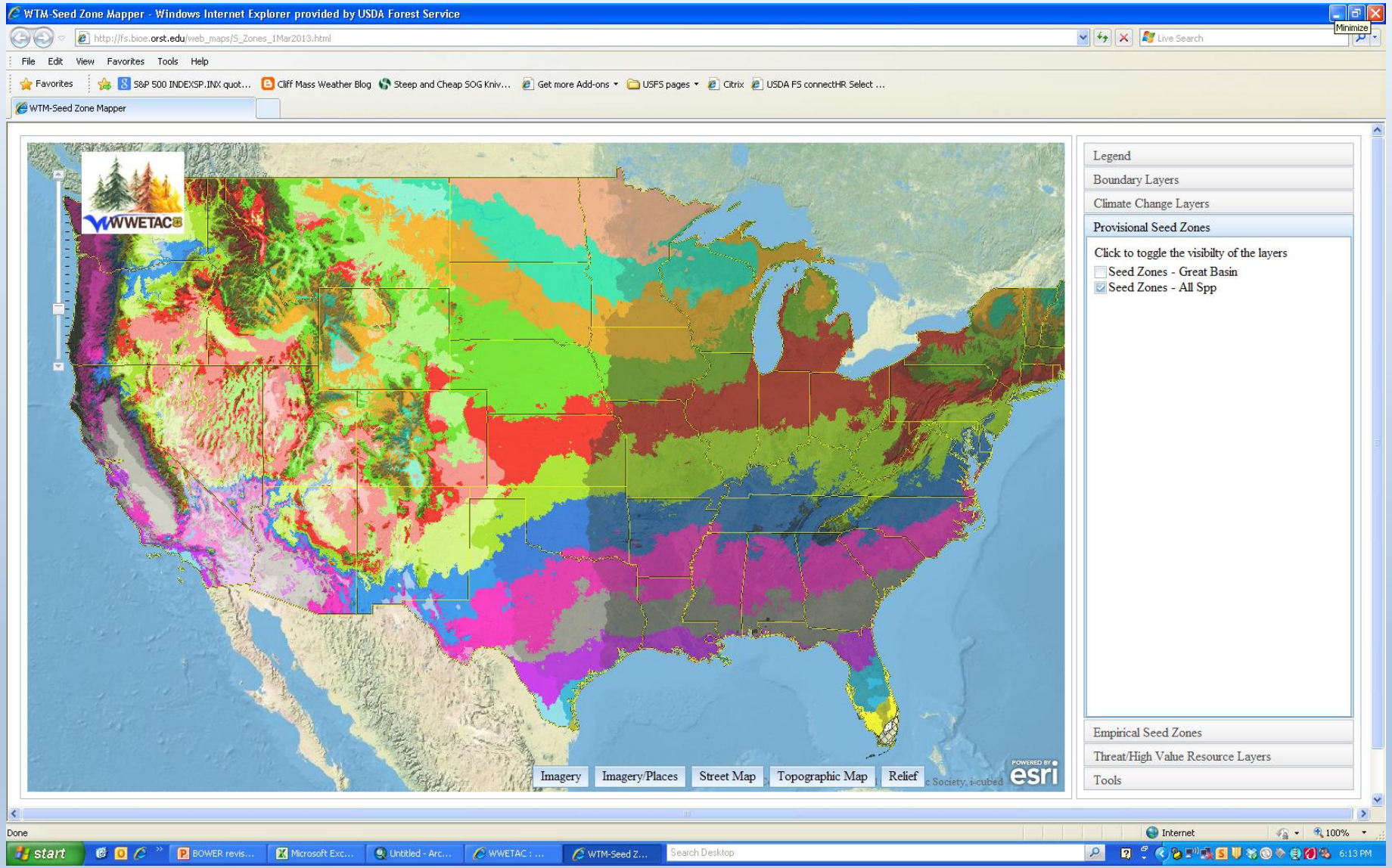

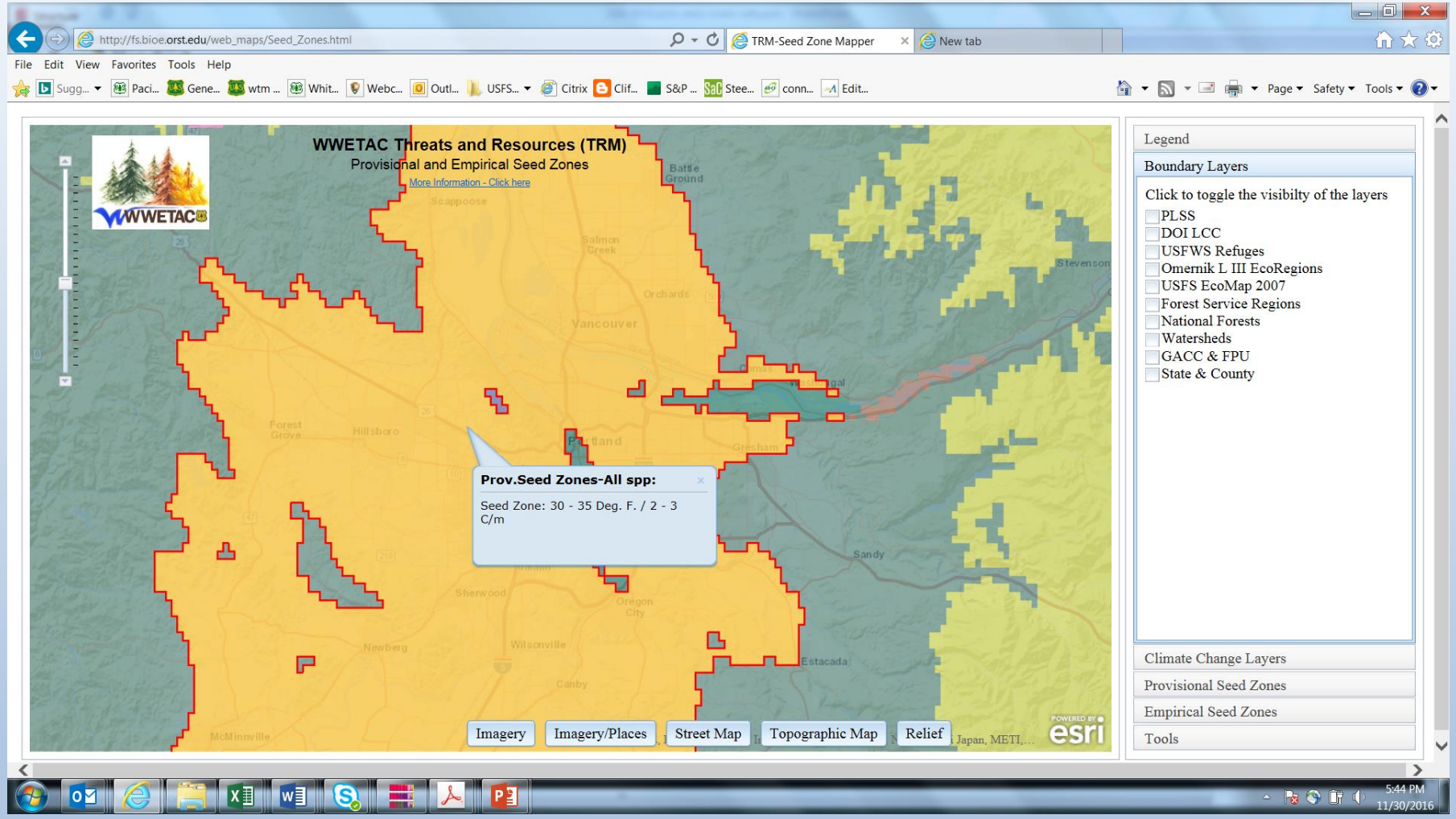
http://fs.bioe.orst.edu/web_maps/Seed_Zones.html
TRM-Seed Zone Mapper
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WWETAC Threats and Resources (TRM)
Provisional and Empirical Seed Zones
More Information - Click here
Prov.Seed Zones-All spp:
Seed Zone: 30 - 35 Deg. F. / 2 - 3 C/m
Imagery
Imagery/Places
Street Map
Topographic Map
Relief
Legend
Boundary Layers
Click to toggle the visibilty of the layers
PLSS
DOI LCC
USFWS Refuges
Omernik L III EcoRegions
USFS EcoMap 2007
Forest Service Regions
National Forests
Watersheds
GACC & FPU
State & County
Climate Change Layers
Provisional Seed Zones
Empirical Seed Zones
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Seed Zone Data and Publications

http://www.fs.fed.us/wwetac/threat-map/TRMSeedZoneData.php

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Seed Zone GIS Data

Provisional Seed Zones

Dataset	Extent	Download	Map	More Info
Provisional Seed Zones for all Species	CONUS	Shapefile	PDF	PDF

Edited Provisional Seed Zones

Dataset	Extent	Download	Map	More Info
Edited Provisional Seed Zones	Great Basin	Shapefile	PDF	PDF

Empirical (Common Garden Studies) Seed Zones

Dataset	Extent	Download	Map	More Info
Blue wildrye (*Elymus glaucus*)	Blue Mountains Ecoregion (Oregon, WA)	Shapefile	PDF	PDF
Basin wildrye (*Leymus cinereus*)	Columbia Basin - Great Basin	Shapefile	PDF	PDF
Mountain Brome (*Bromus carinatus*)	Blue Mountains Ecoregion (Oregon, WA)	Shapefile	PDF	PDF
Prairie junegrass (*Koelaria macrantha*)	Columbia Basin and Great Basin	Shapefile	PDF	PDF
Bluebunch wheatgrass				

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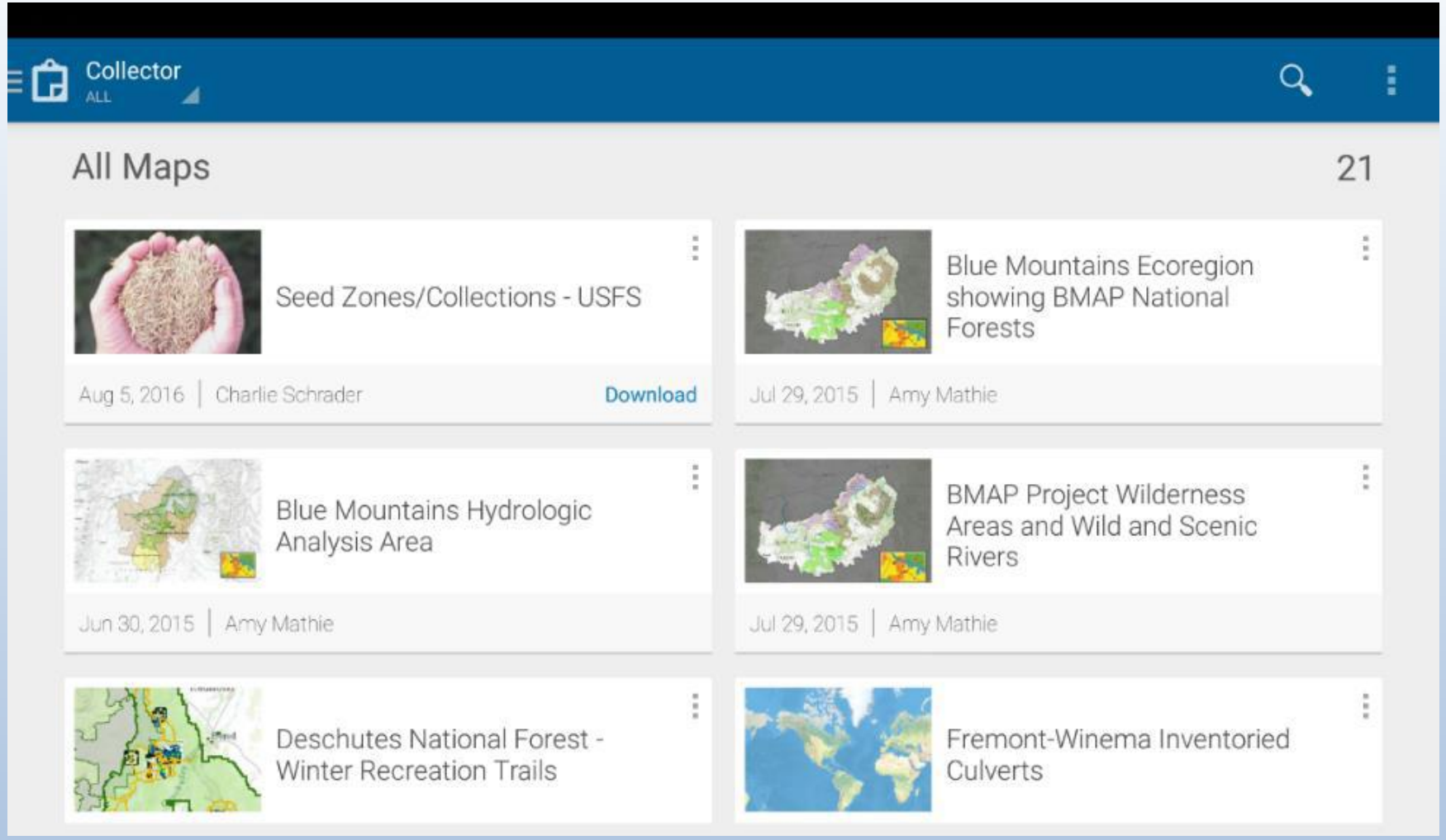
Mobile Seed Zone Apps

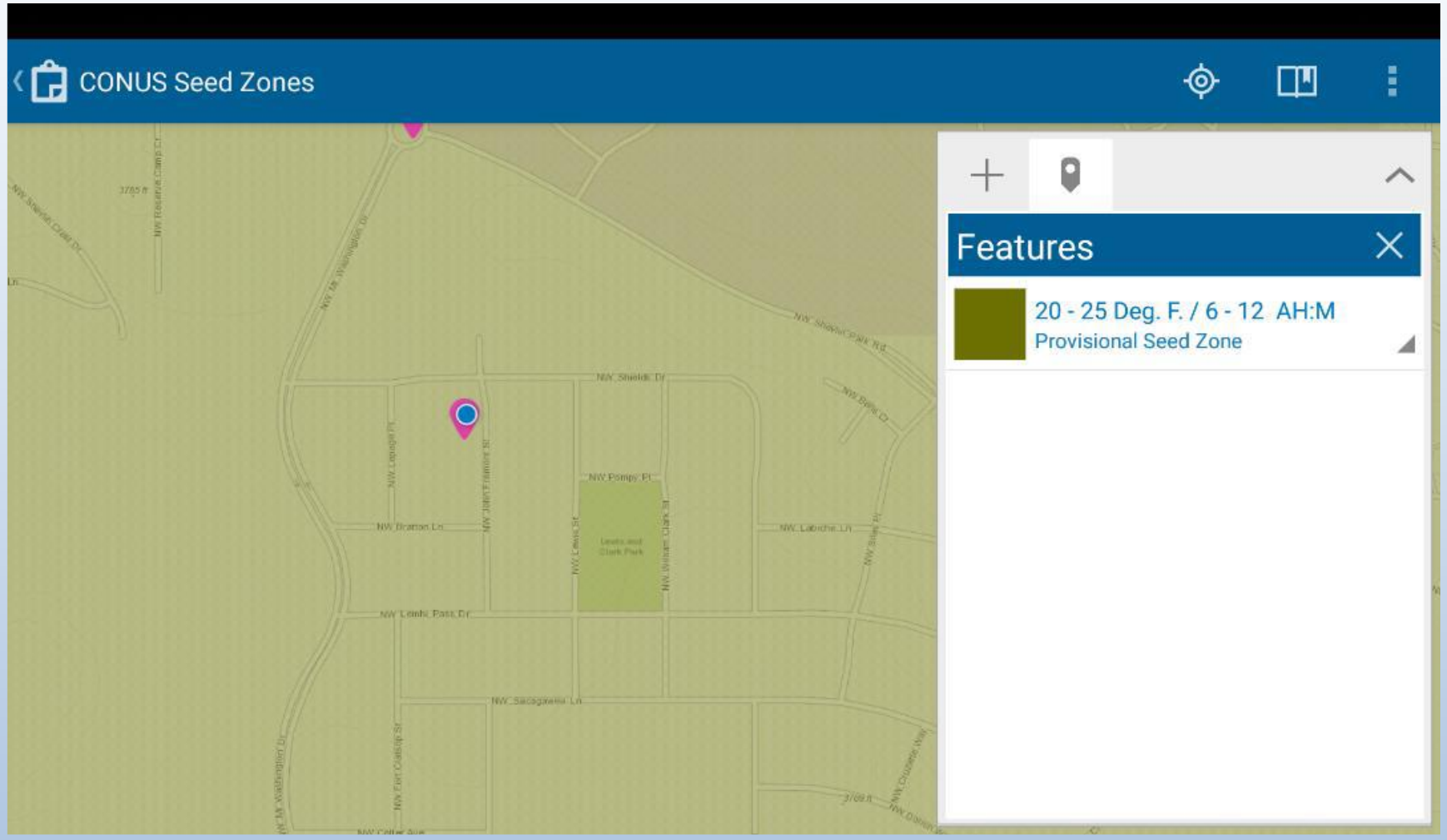
- Collector for ArcGIS-OnLine (For USFS, BLM, State, or other account holders)
  - Scrollable “live” maps in connected environment
  - Downloadable maps for unconnected environment

- GeoQuery Browser
  - Open access (no account needed)
  - Only works in connected environment (cell or WiFi)

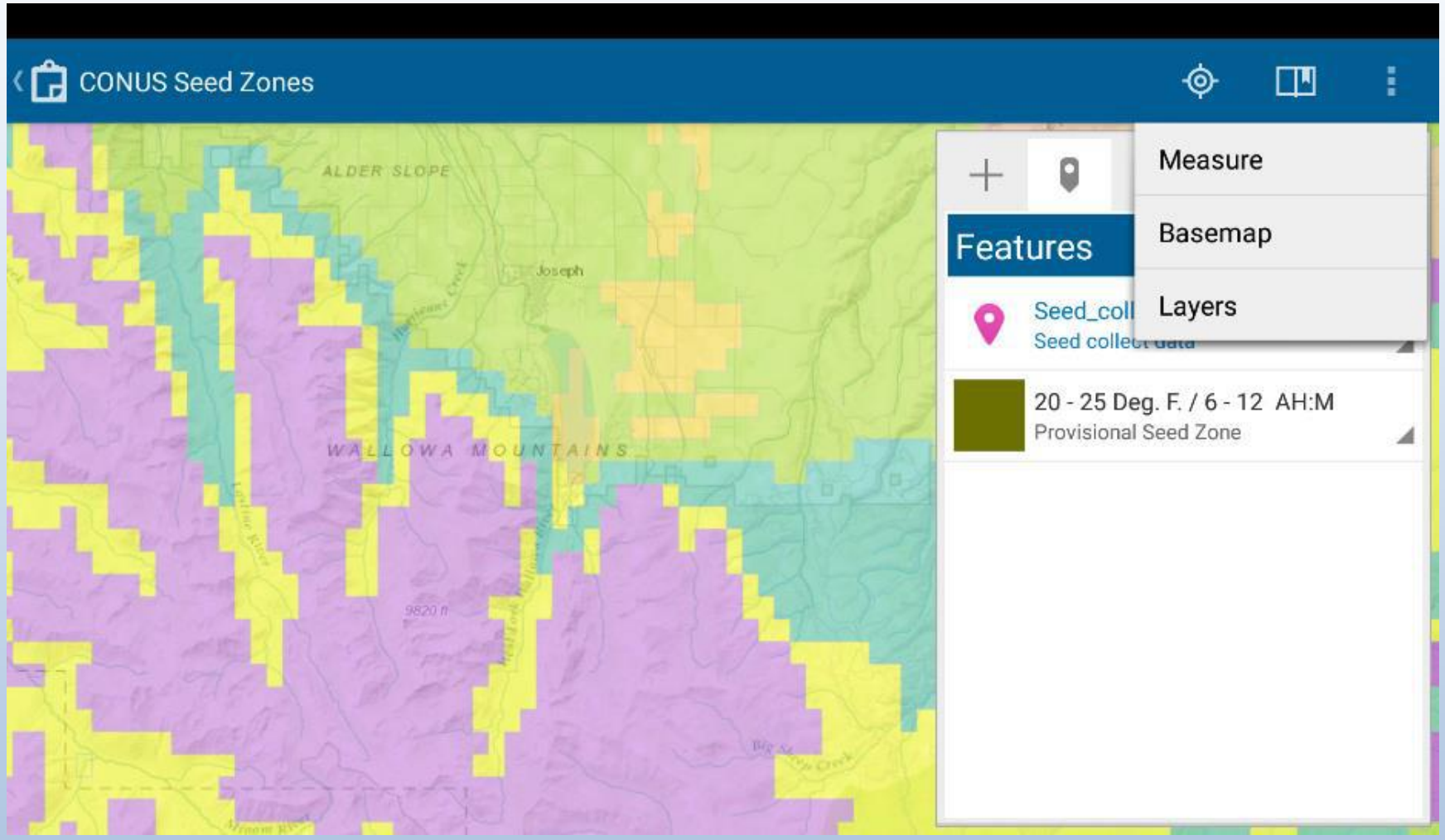
Collector for ArcGIS – free download but AGOL account needed



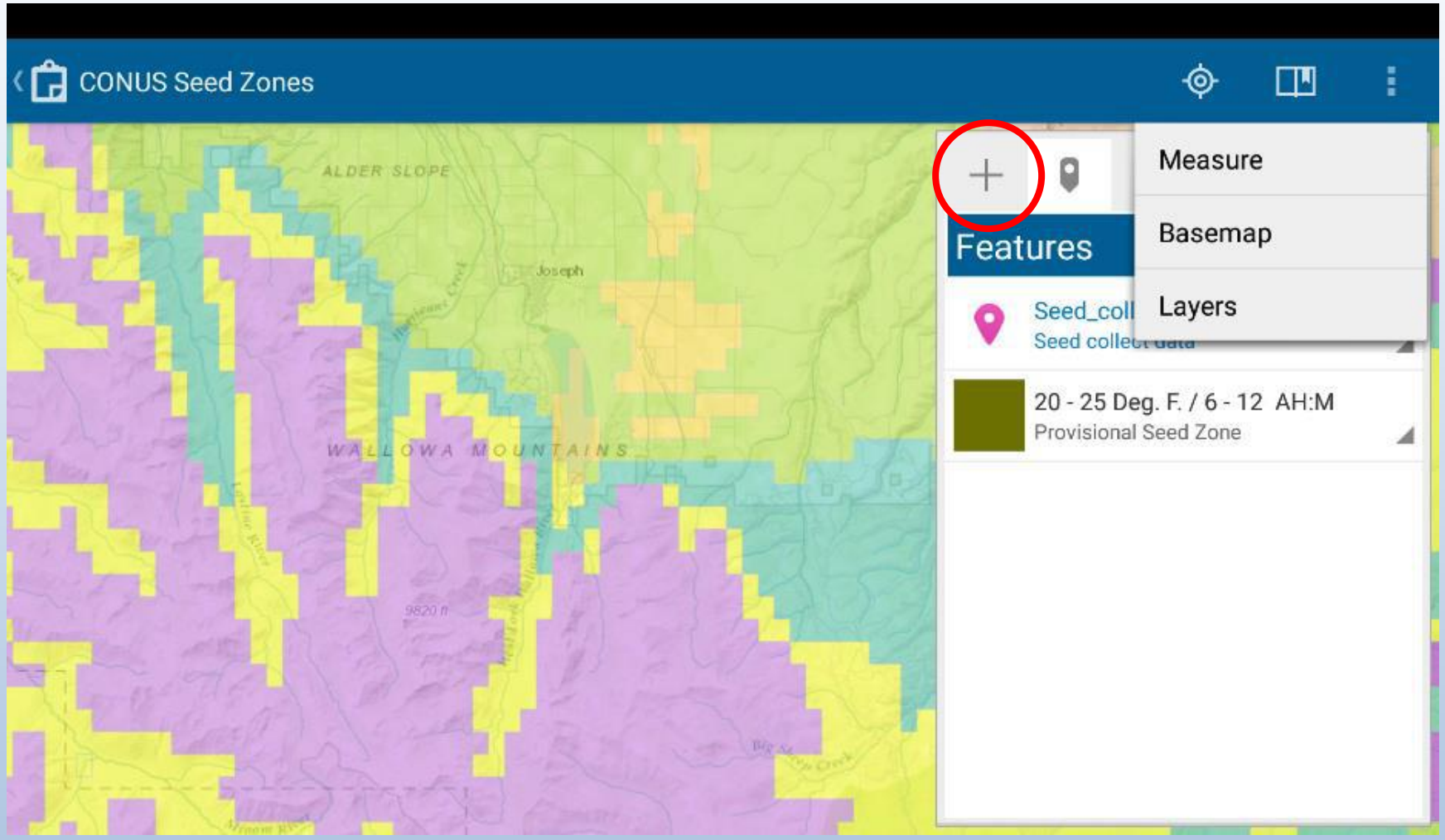
After login all available maps will be displayed. If USFS AGOL user map will be “Seed Zone/Collections – USFS”



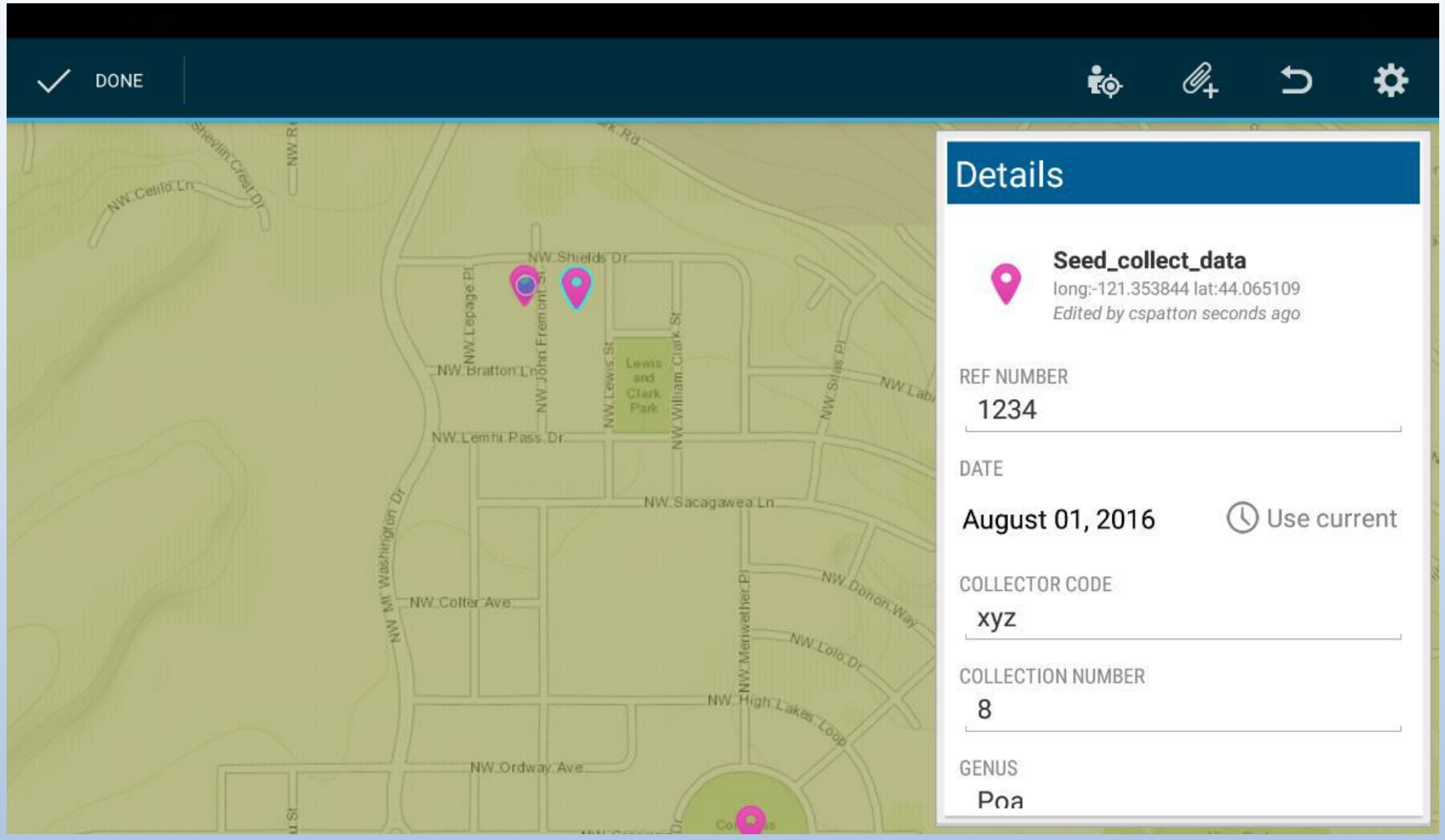
Map opens showing your current location using device GPS (blue dot), tap the screen to display the Seed Zone



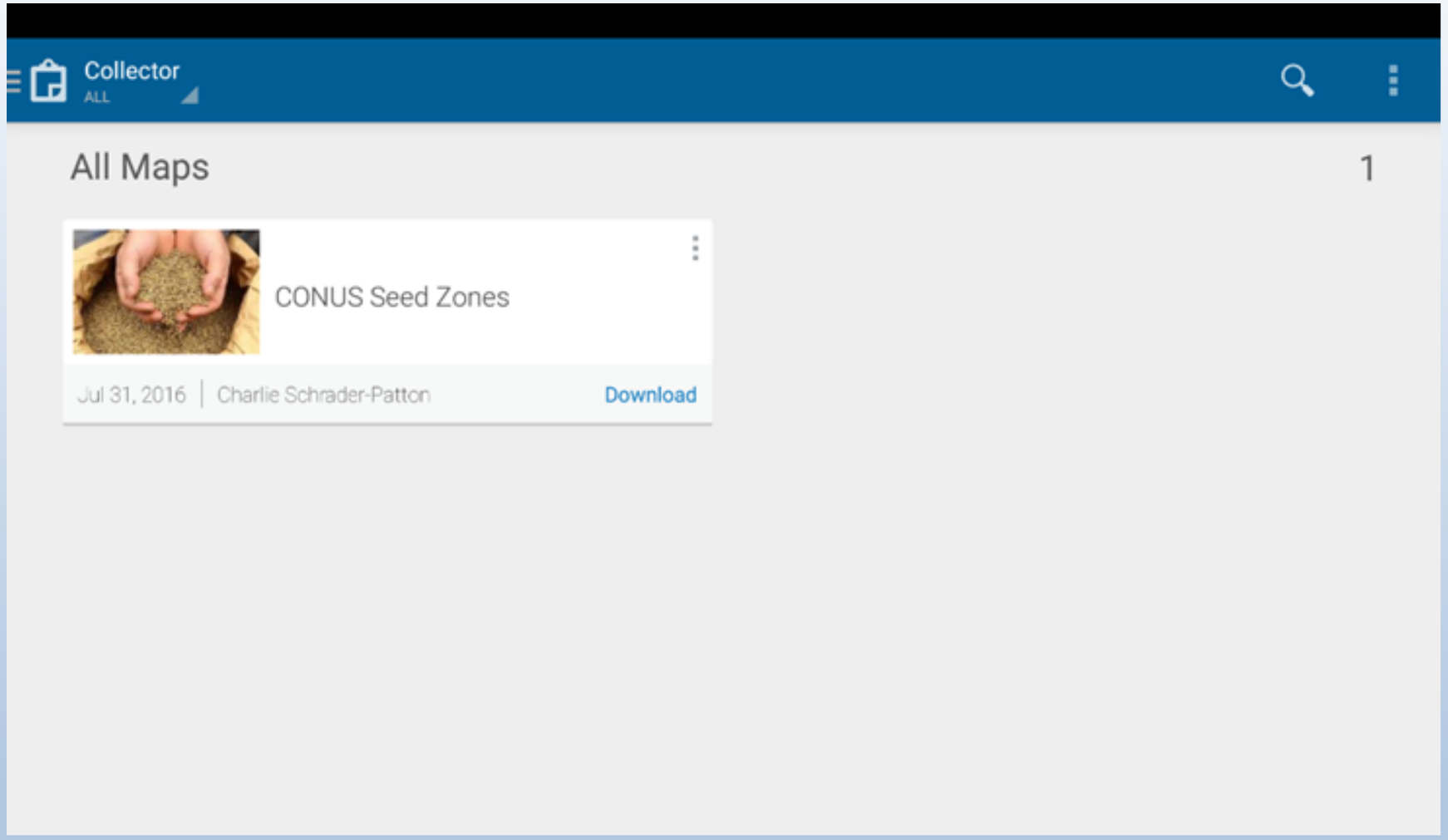
Zoom out and tap to display other seed zones and select basemap and other layers



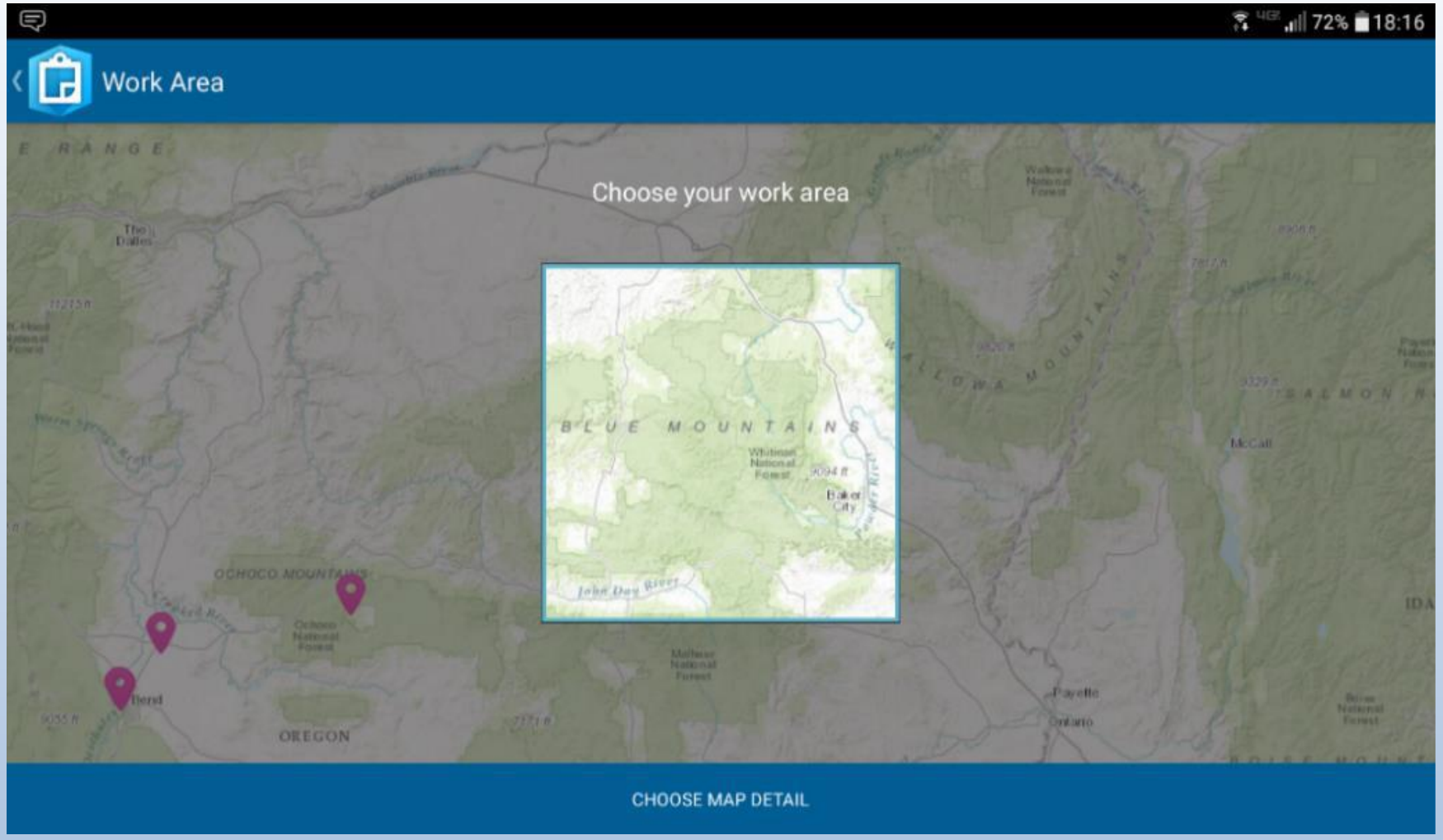
Tap “+” button to collect a new feature at your current location



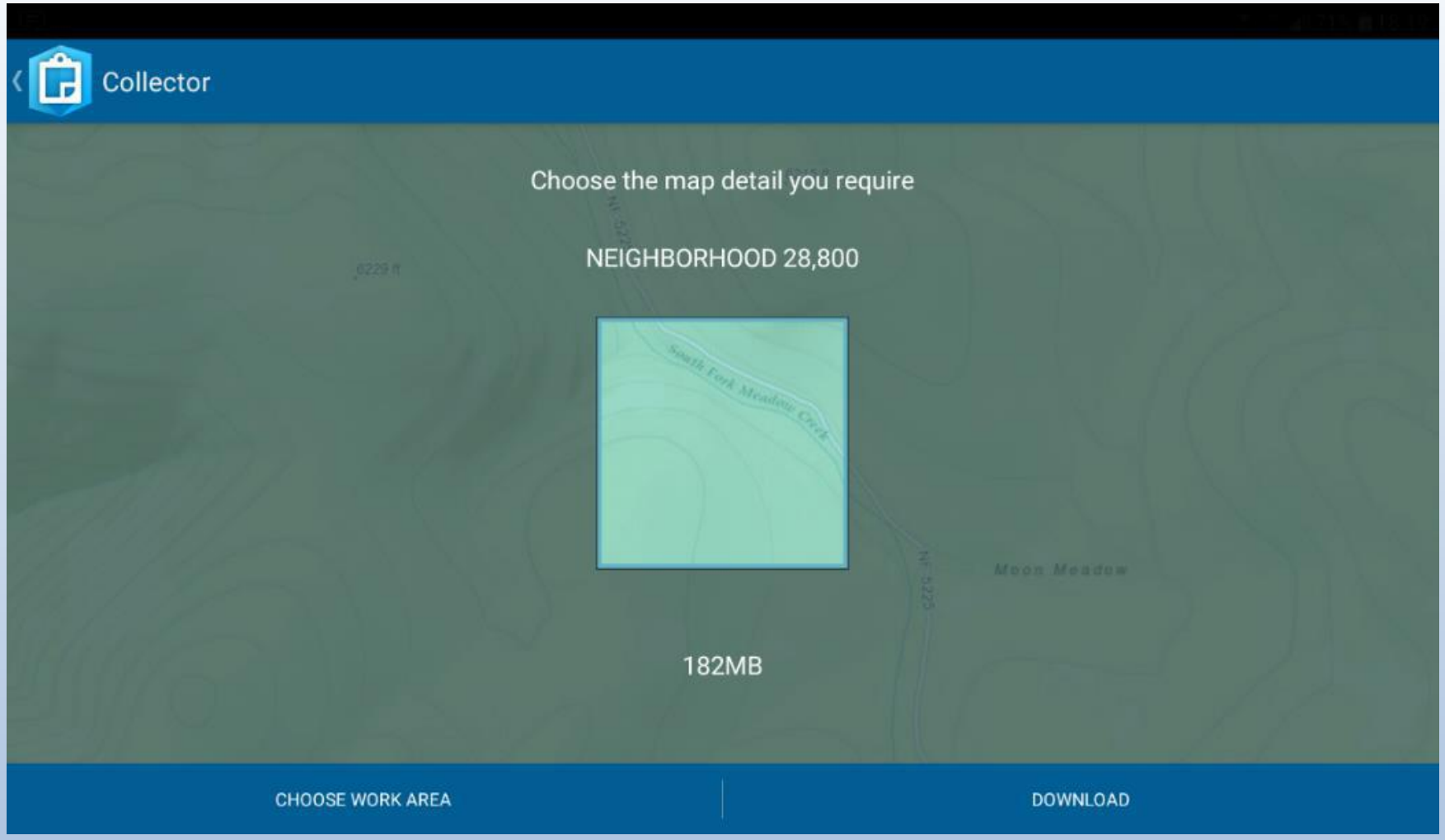
This opens a form to collect information on a seed collection



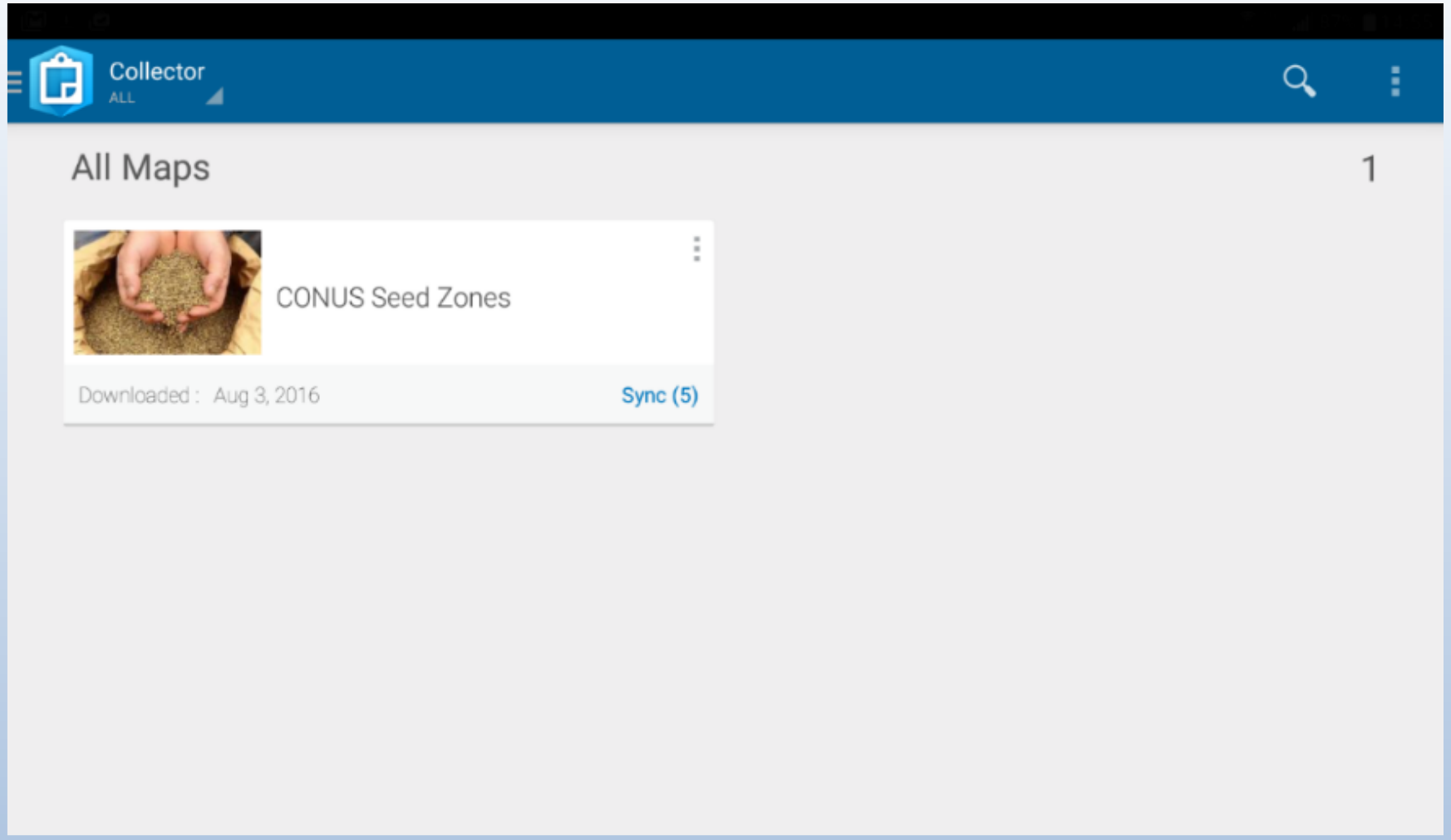
Use offline requires downloading map data for applicable area while still in a connected environment



Zoom and scroll to select your work area



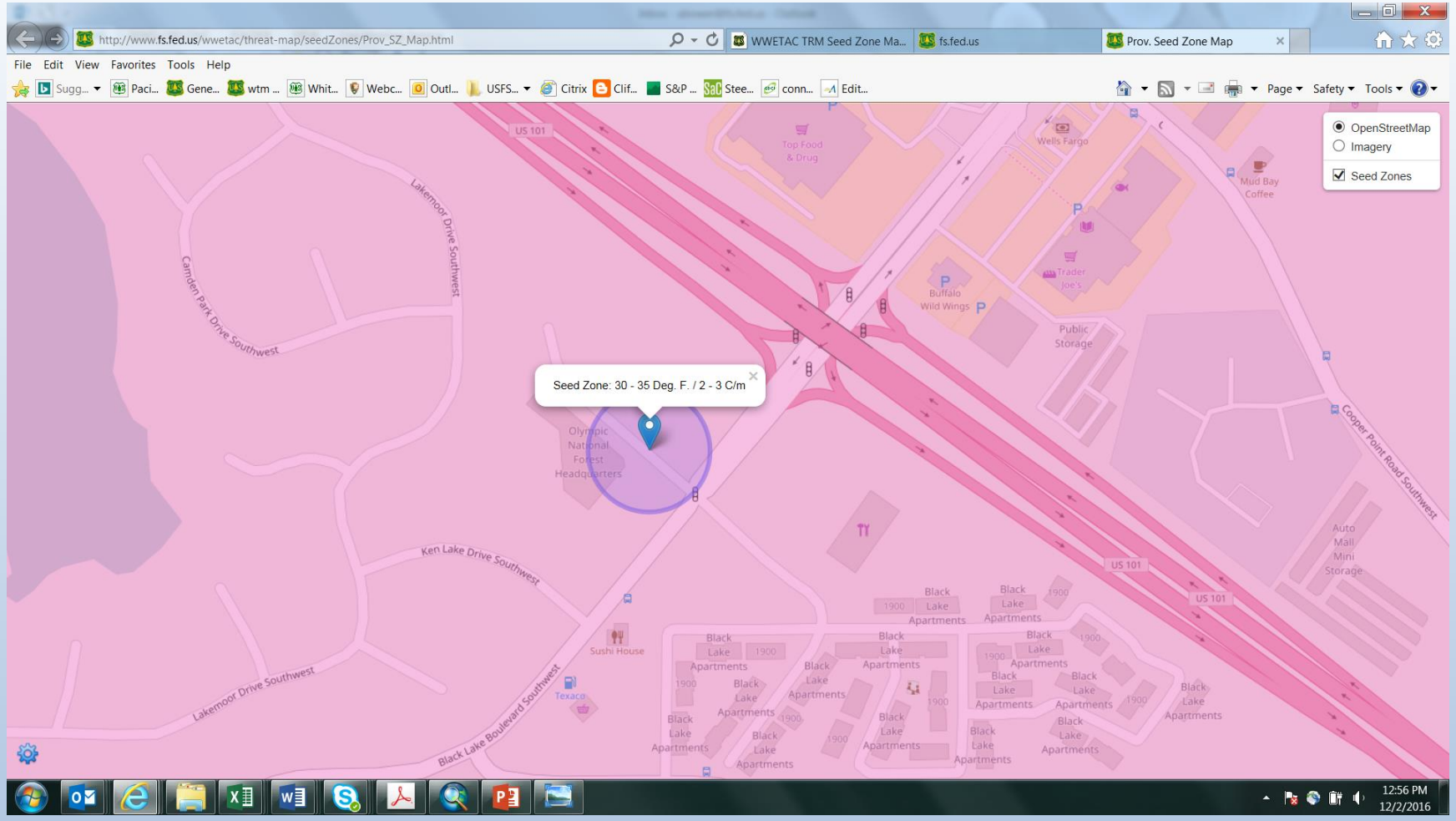
Zoom to select map detail (resolution). Higher resolution = larger file size



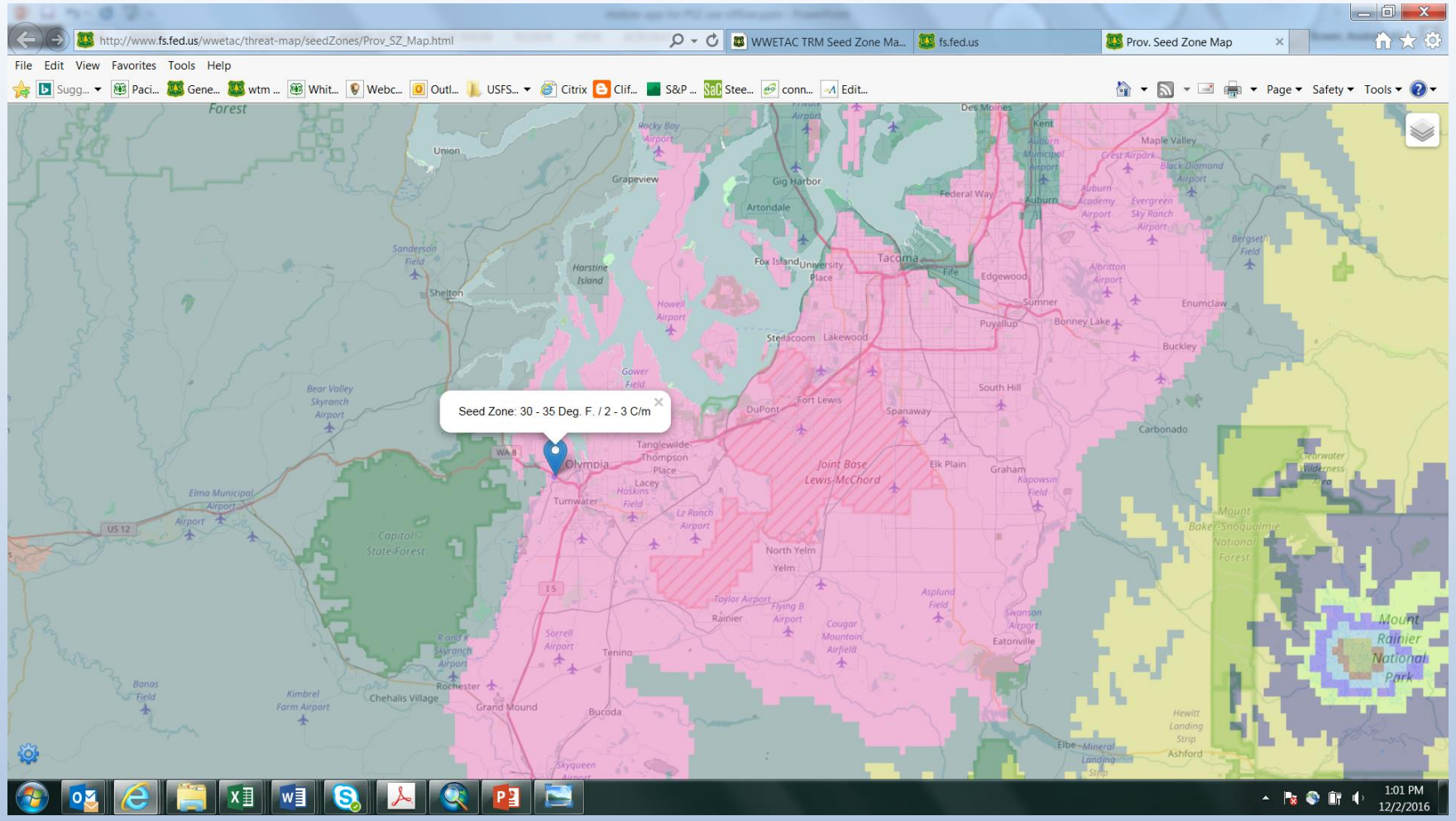
Once map layers are downloaded use is the same. Map home page will show the number of points collected which are then sync'd when device is reconnected

Mobile Seed Zone Apps

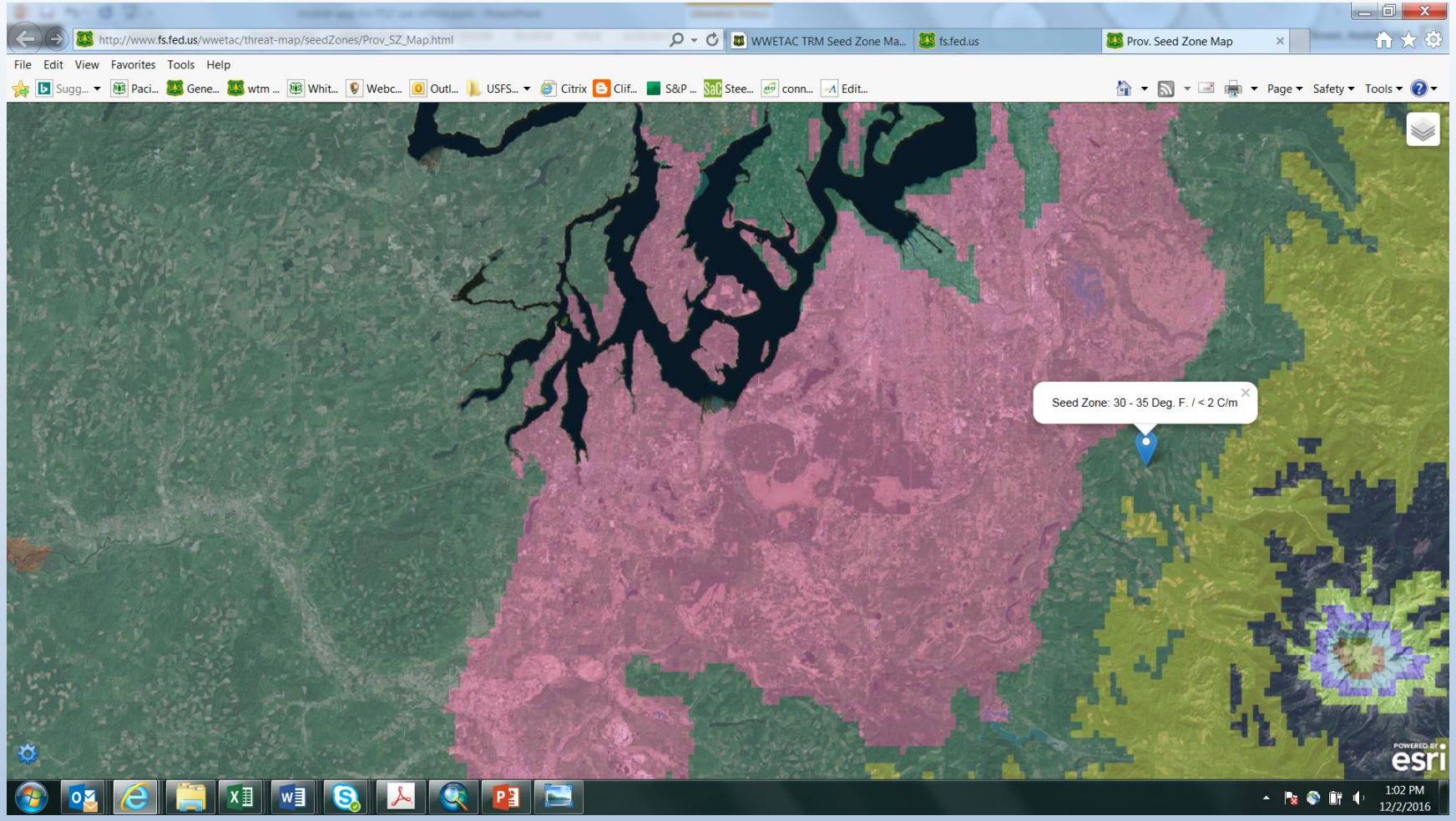
- GeoQuery Browser
  - Open access (no account needed)
  - Currently only works in connected environment (cell or WiFi)
  - Shows current location (using device GPS) and seed zone information
  - Scroll/Zoom/Tap to identify other seed zones



Current location shown by marker with Seed Zone layer turned on, using street map basemap



Zoom/Scroll to change map extent and show surrounding seed zones



Can also change basemap to satellite imagery. Click on any location to display seed zone at that location

COMING SOON!

- Android and iOS seed zone applications that function in both an connected and disconnnected environments. Stay tuned!

For the latest info, contact:

- Andy Bower abower@fs.fed.us

  or

- Charlie Schrader-Patton. cschrader@fs.fed.us