



United States Department of Agriculture  
**Agricultural Research Service**  
the in-house research arm of the USDA



# **Crop wild relatives of *Medicago* in Russia and neighbouring countries: gap analysis for effective conservation**



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Crops in the genus *Medicago*  
Important forage, fodder and soil improvers

**Lucerne (alfalfa)-Queen of legume forages**

**Annual medic species- soil improvement**

# *Medicago* Wild Relatives

## Lucerne Primary Gene Pool

Tetraploid forms in *Medicago sativa* complex:



*Medicago sativa* subsp. *sativa*  
subsp. *falcata*  
subsp. *falcata* var *viscosa*  
nothsubsp. *varia*  
subsp. *glomerata*  
subsp. *sativa* x subsp. *glomerata*



(Taxonomy  
according to  
Small 2010)

# *Medicago* Wild Relatives

## Lucerne Secondary Gene Pool



*Medicago papillosa*  
*M. saxatilis*

## Lucerne Tertiary Gene Pool

Diploid versions in *Medicago sativa*  
complex:

*Medicago sativa* subsp. *caerulea*  
subsp. *falcata*  
subsp. *falcata* var *viscosa*  
nothsubsp. *varia*  
subsp. *glomerata*  
subsp. *sativa* x subsp. *glomerata*

*M. cancellata*†  
*M. daghestanica*  
*M. marina*  
*M. rupestris*†

# Geographic distribution in the FSU Area



*Medicago sativa* subsp. *sativa*

# Geographic distribution in the FSU Area

subsp. *sativa*



*Medicago sativa* subsp. *falcata*


# Geographic distribution in the FSU Area

subsp. *sativa* ■ subsp. *falcata* ■



*M. sativa* subsp. *falcata* var. *viscosa*

# Geographic distribution in the FSU Area

subsp. *sativa*  subsp. *falcata* 



*M. sativa* nothosubsp. *varia*

# Geographic distribution in the FSU Area

subsp. *sativa* ■ subsp. *falcata* ■ nothosubsp. *varia* ■



*M. sativa* subsp. *glomerata*

# Geographic distribution in the FSU Area

subsp. *sativa* ■ subsp. *falcata* ■ nothosubsp. *varia* ■ subsp. *glomerata* ■



*Medicago sativa* subsp. *sativa* X subsp. *glomerata*

# Geographic distribution in the FSU Area

subsp. *sativa* ■ subsp. *falcata* ■ nothosubsp. *varia* ■ subsp. *glomerata* ■



*Medicago sativa* subsp. *sativa* X subsp. *glomerata*

# *Medicago* Wild Relatives

## Annual Medic Species- Primary Gene Pool

Wild forms of cultivated species:

*M.arabica*

*M.littoralis*

*M.lupulina*

*M.minima*

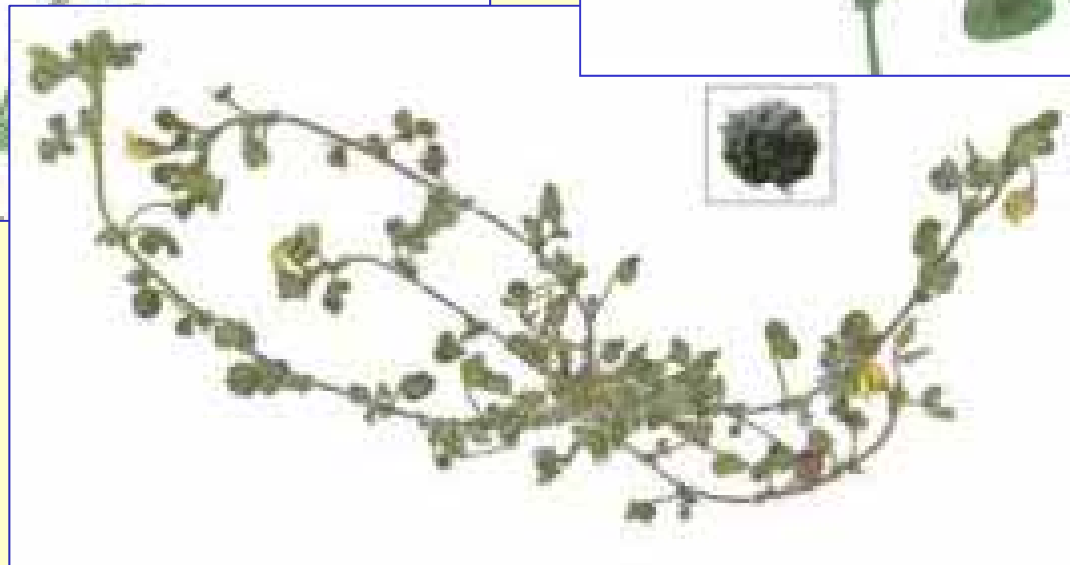
*M.orbicularis*

*M.polymorpha*

*M.rigidula*

*M.scutellata*

*M.truncatula*



# Annual Species

**M. polymorpha**



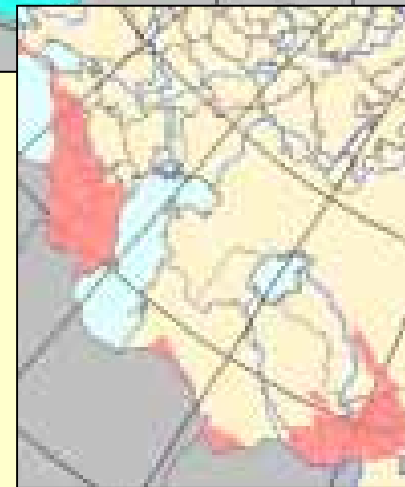
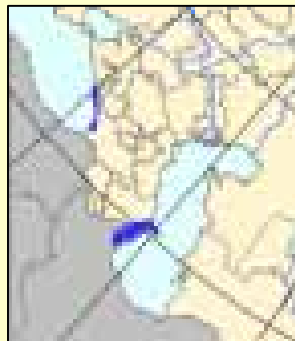
**M. lupulina**



**M. minima**



**M. littoralis**



**M. arabicus**



**M. orbicularis**

# Ex situ assessment

- Collections reviewed

USDA

VIR

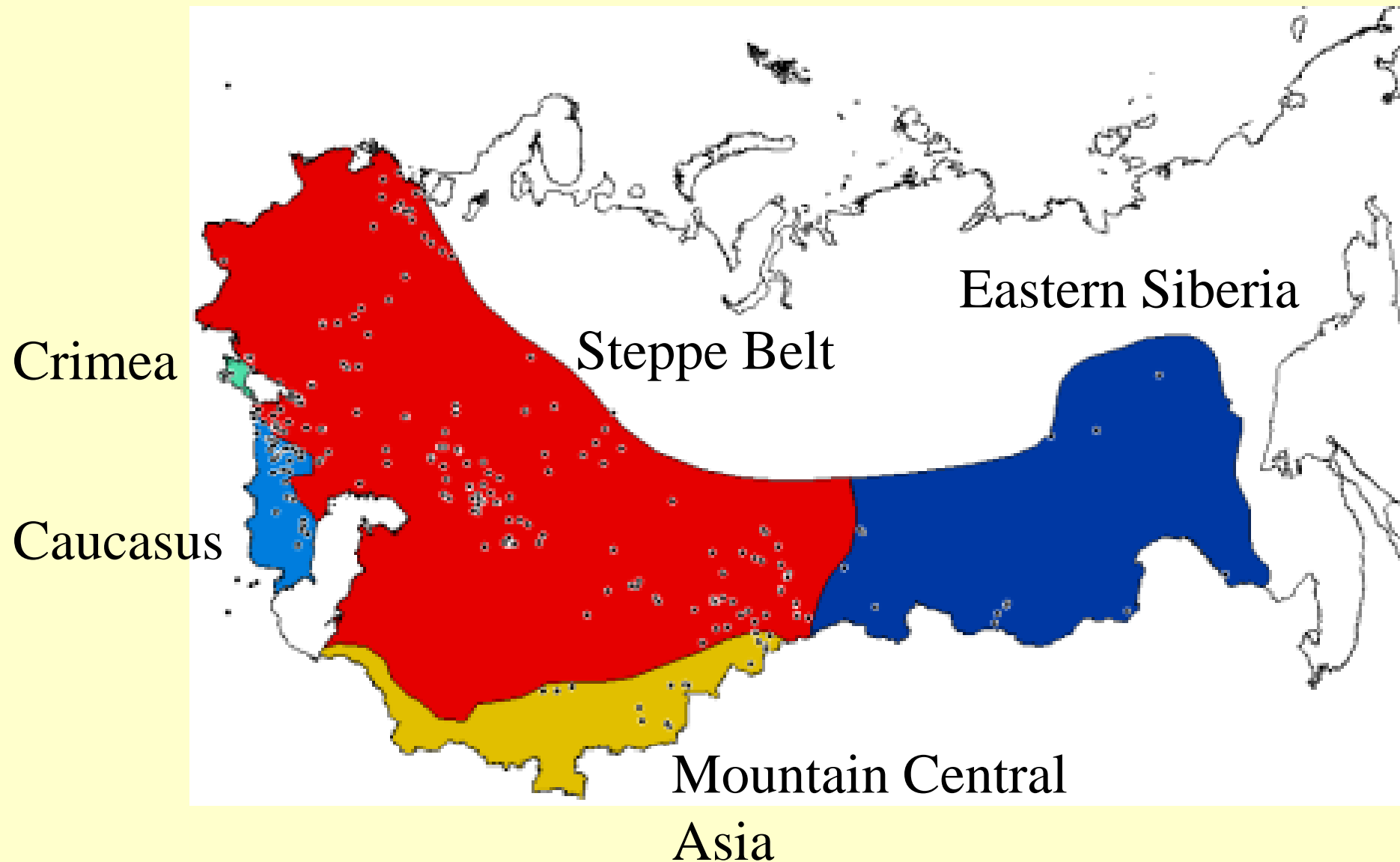
ICARDA

Australia (SARDI)

Collections in Eurisco database

- Duplicates among collections not counted
- Cultivated forms not counted
- Area of FSU classified into 5 ecogeographic zones

# Ecogeographic zones where Medicago species occur



# Ex situ representation of ecogeographic zones- perennials

	Crimea	Caucasus	Mountain Central Asia	Steppe Belt	Eastern Siberia
<i>M. cancellata</i> †		7		0	0
<i>M. daghestanica</i>		4			
<i>M. marina</i>	0	0			
<i>M. papillosa</i>		3			
<i>M. rupestris</i> †	0				
<i>M. sativa</i> nsubsp. <i>varia</i>	11	41	14	242	0
ssp. <i>caerulea</i>		53		48	
ssp. <i>falcata</i>	7	66	28	468	16
ssp. <i>falcata</i> var <i>viscosa</i>	8	0			
ssp. <i>glomerata</i>	1	43		1	
ssp. <i>sativa</i>	0	272	167	226	3
<i>sativa</i> x <i>glomerata</i>	1	20			
<i>M. saxatilis</i>	1				

endemic

† endangered, vulnerable

# Ex situ representation of ecogeographic zones- annuals

	Crimea	Caucasus	Mountain Central Asia	Steppe Belt	Eastern Siberia
<i>M. arabica</i>	14	26			
<i>M. littoralis</i>		23			
<i>M. lupulina</i>	8	40	10	96	
<i>M. minima</i>	29	49	71	5	
<i>M. orbicularis</i>	33	58	30		
<i>M. polymorpha</i>	13	52	22		
<i>M. rigidula</i>	25	33	49		
<i>M. scutellata</i>			2	3	
<i>M. truncatula</i>		18?	1		

endemic

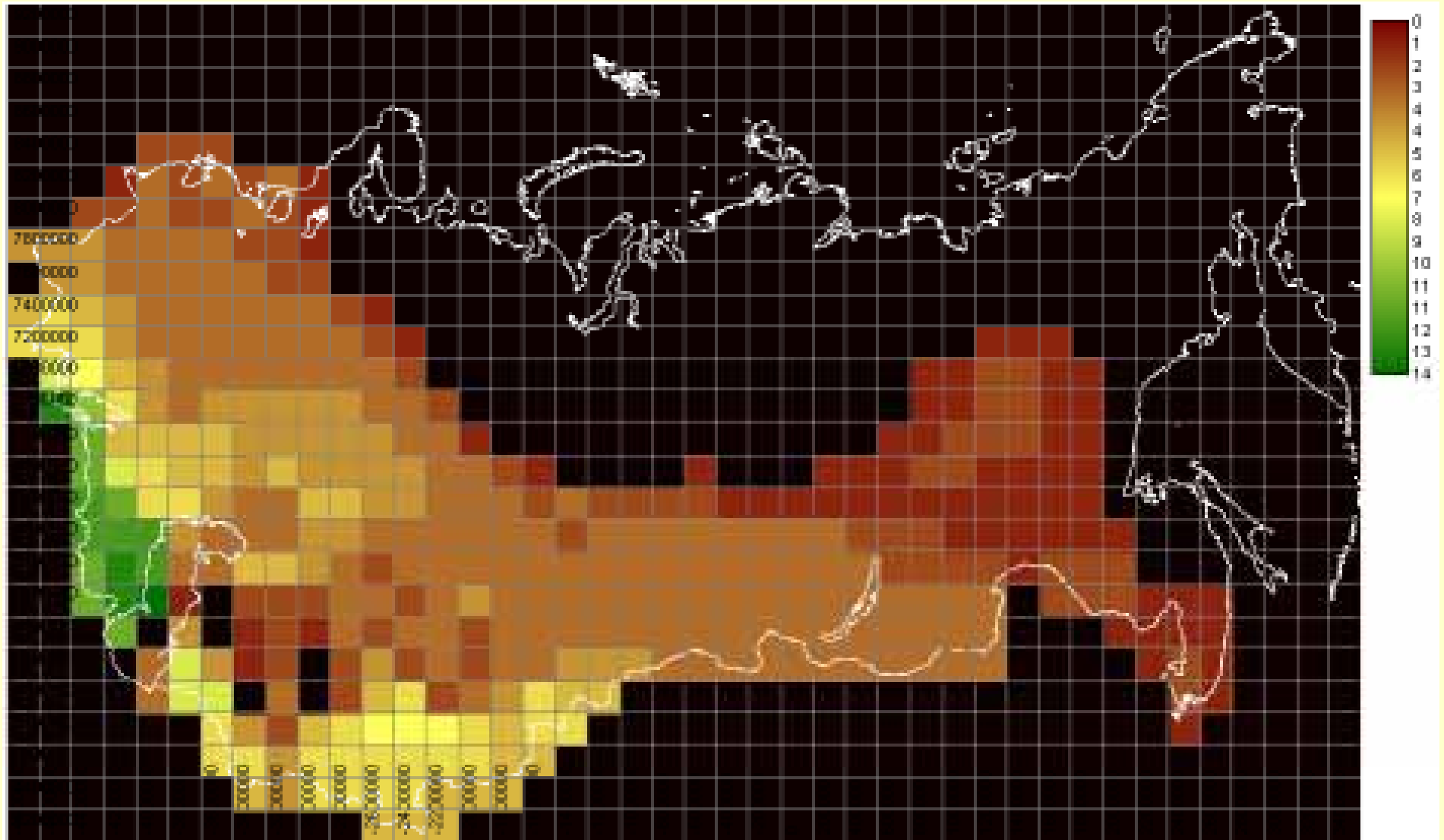
† endangered, vulnerable

# In situ Assessment



- Species distribution maps were used to develop a species richness map
- Polygons of protected areas classified as zapovedniks were downloaded and overlaid on species richness map
- Species inventories of zapovedniks were obtained
- GIS software- IDRISI

# CWR Taxa Richness Map





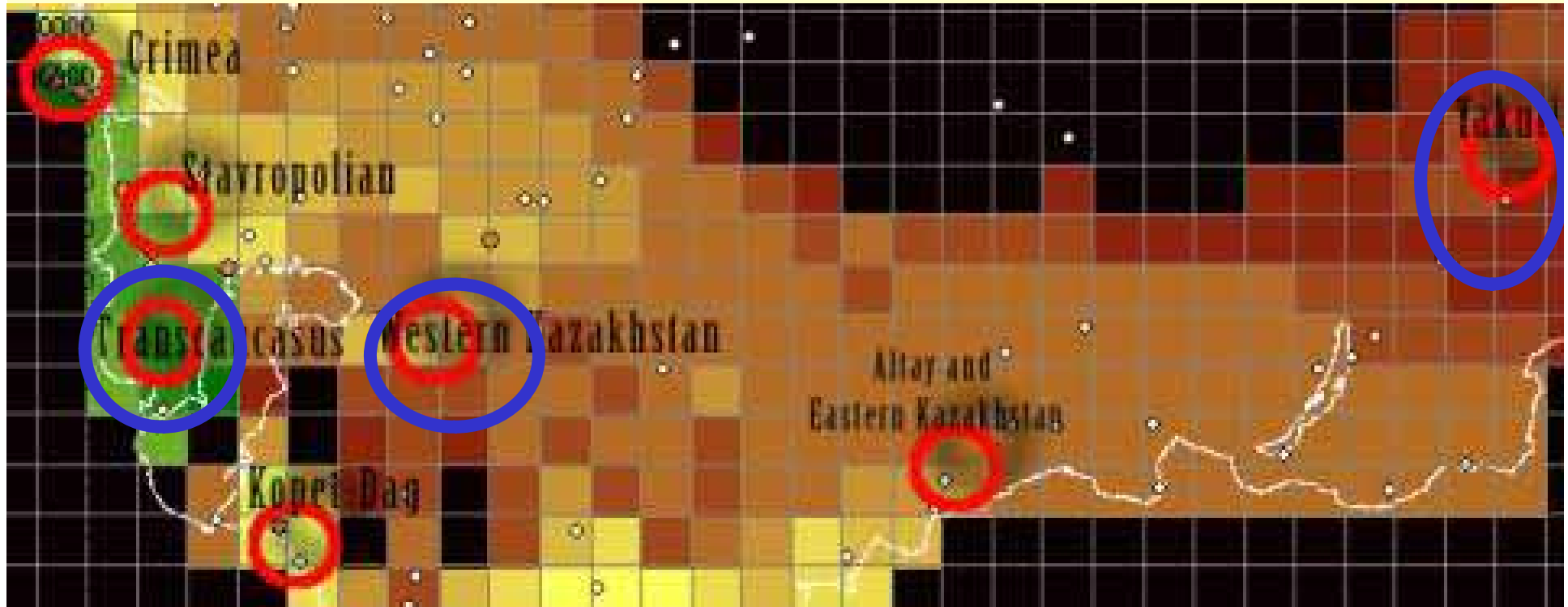
# Small Number of Reserves Could Capture Taxa Diversity



○ Geographic Regions of Medicago  
CWR Taxa Diversity

● Natural Preserves with Documented Occurrence

# Small Number of Reserves Could Capture Taxa Diversity

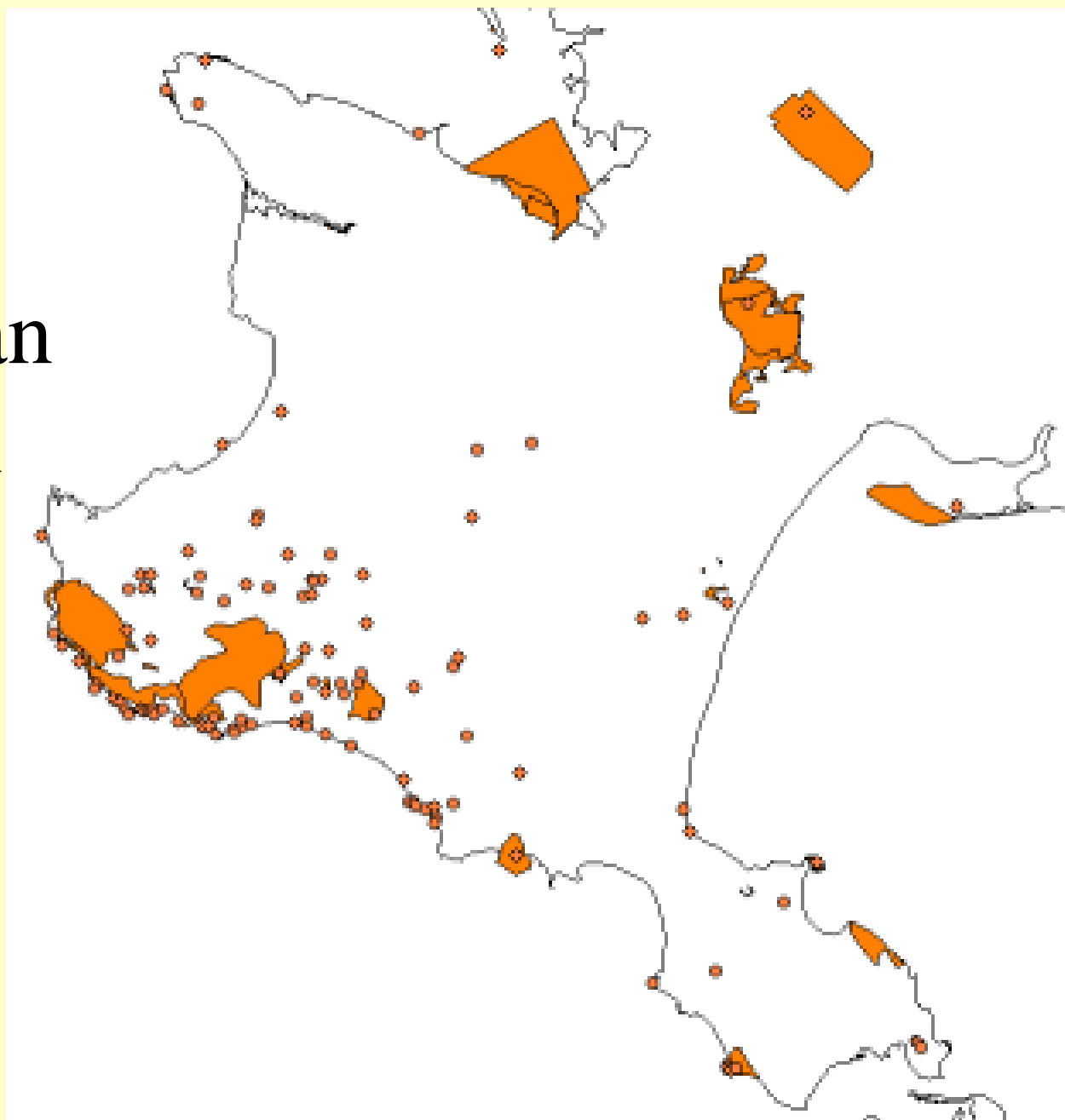


○ Geographic Regions of Medicago CWR Taxa Diversity

● Natural Preserves with Documented Occurrence

Lesson  
Learned in  
our Crimean  
Exploration  
2008

Importance  
of Ground  
Truthing



# Natural Reserves



Medics Rarely Found



# Anthropogenic Sites



Medics were common

# Conclusions

- Ex situ gaps occur for perennial CWR species outside the *M. sativa* complex, including vulnerable species
- Eastern Siberia is underrepresented
- Northern-most extent of annual medics is underrepresented
- Seven geographic areas capture taxa diversity and Nature Reserves occur in most of these areas and some *Medicago* appear on their inventories
- Further work is needed to determine if gaps occur for in situ protection in Yukutia, Transcaucasus and Western Kazakhstan areas
- In situ conservation of annual *Medicago* species may be most effective in disturbed sites