"*Juniperus* (Cupressaceae) Species Hybridization in Western South Dakota"

Samantha Nelson

Species Examined

Fig. 1 *Juniperus scopulorum*

Fig. 2 *Juniperus virginiana*

Fig. 3 *Juniperus horizontalis*

Source: Windfield Photographic Collection and Archives POB

340 Stn. B London Ontario N6A 4W1

Range

Fig. 4 Range of *Juniperus horizontalis*

Source: Gymnosperm Database

Range

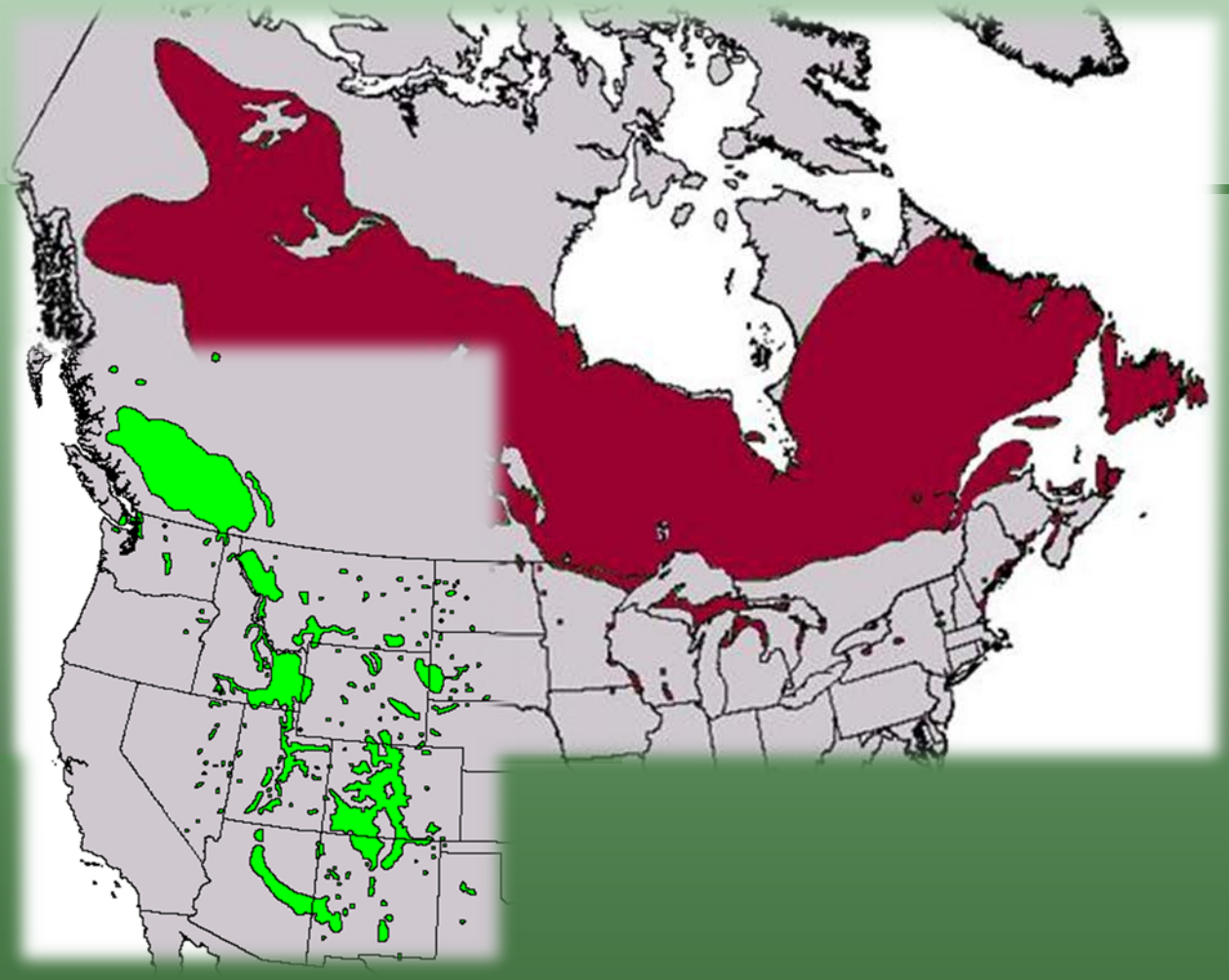

Fig. 5 Range of *Juniperus scopulorum*

Source: Gymnosperm Database

Range

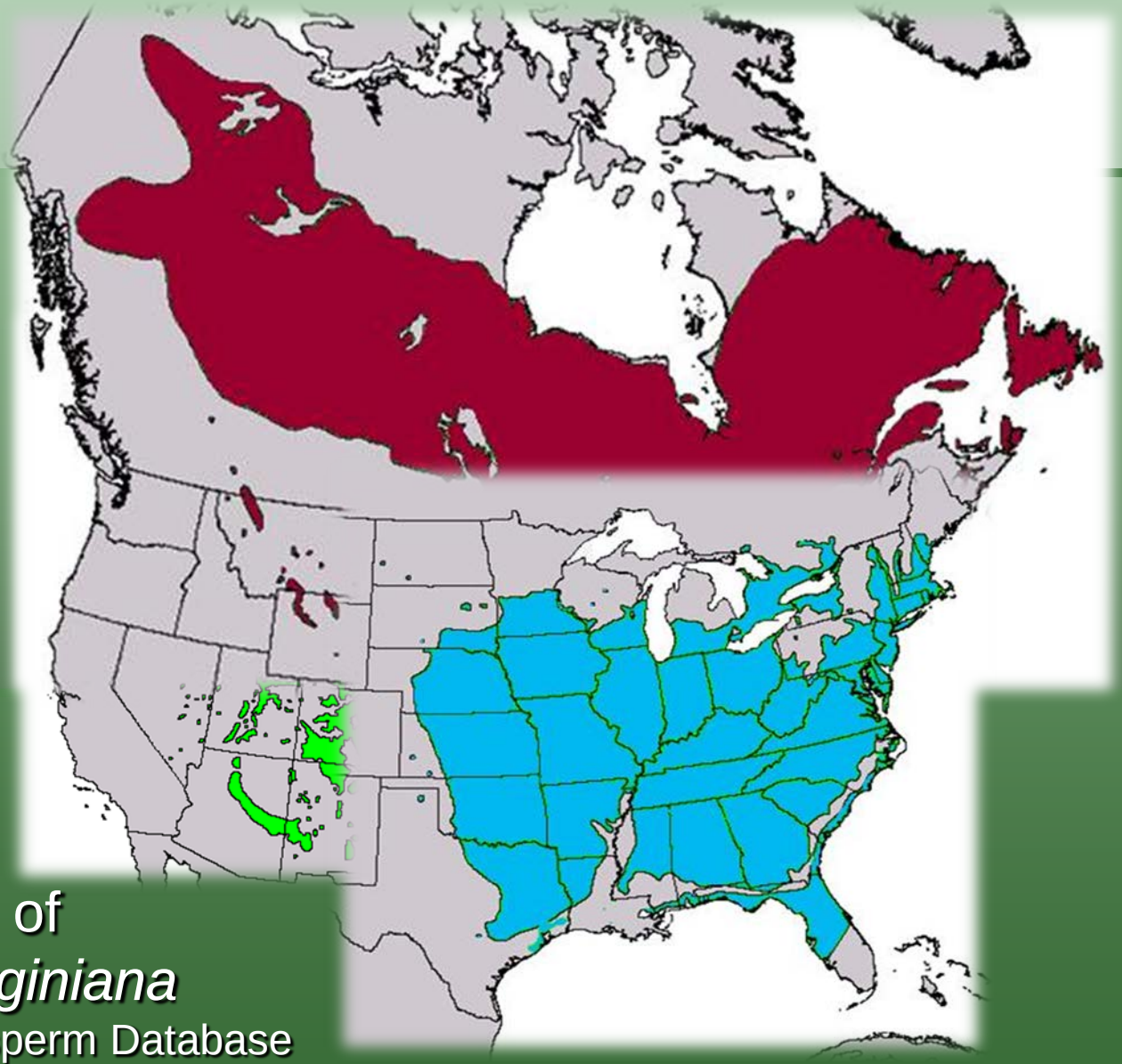

Fig. 6 Range of
Juniperus virginiana
Source: Gymnosperm Database

Objectives

- To look at the range expansion and degree of overlap of *Juniperus scopulorum* and *Juniperus virginiana.*
- To look at the degree and geographical distribution of hybridization between *Juniperus scopulorum* and *Juniperus virginiana*.
- To confirm or refute the existence of *Juniperus blancoi* in the Black Hills area.

Locations Sampled

- Nelson Ranch
  - Pennington Co.
- Spearfish Canyon
- Mc Nenny Fish Hatchery
- Bear Lodge Mountains
- Hwy 14
  - Rapid City—Beresford, SD
- Hwy 34
  - Sturgis—Pierre, SD

Fig. 7 Dustin Christensen marking sample tree N26.

Sample Collecting

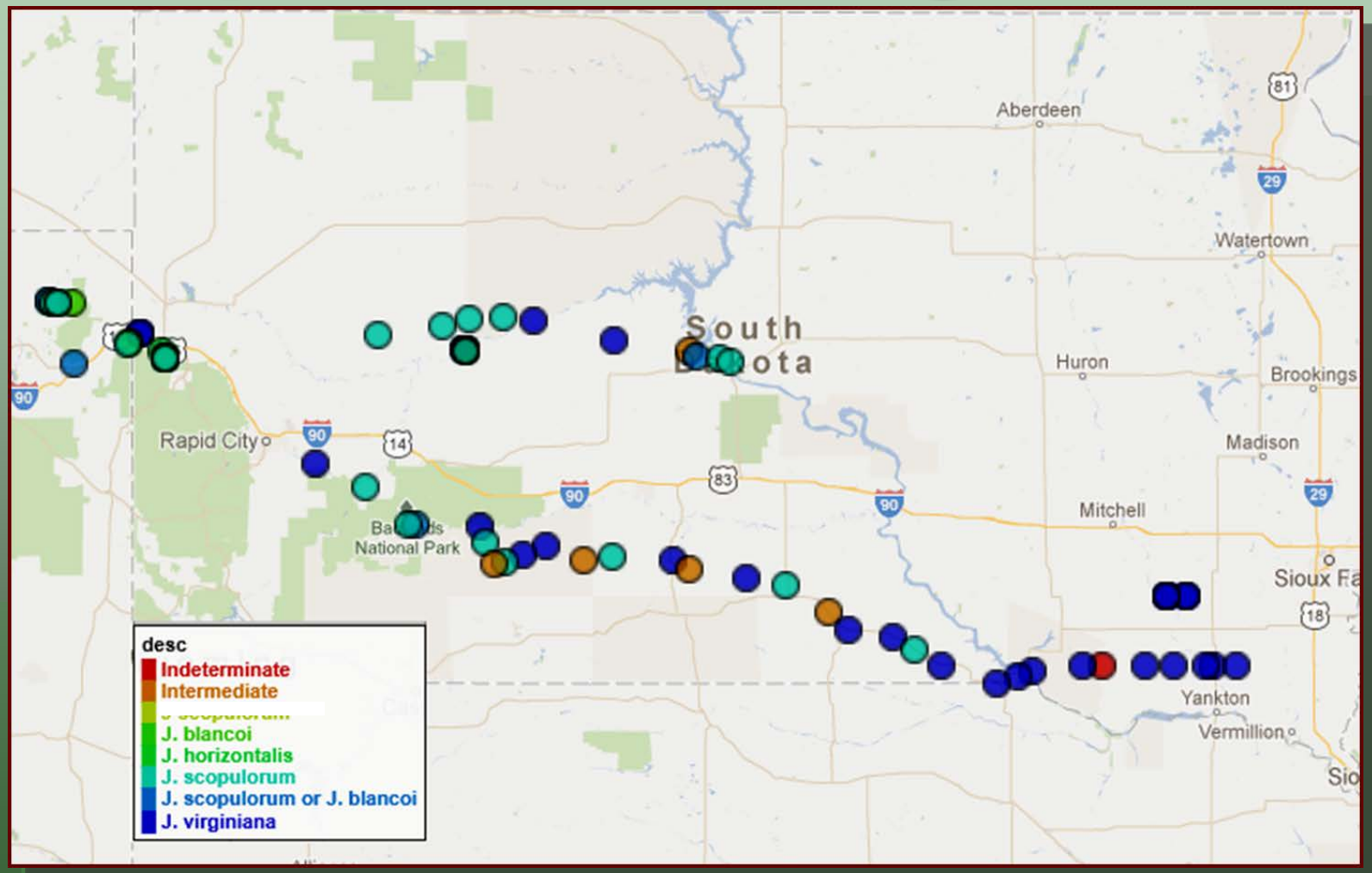

Fig. 8 Collection sites.

Methods

Fig. 10 Taking a written description of a specimen collected near Hulett, WY in the Bear Lodge Mountains.

Fig. 9 Morphological characteristics, shape, height, leaves, and seed cones, that were used to identify the specimens in the field

Methods

- Sequenced two DNA regions
  - nuclear Internal Transcribed Spacer region (ITS)
  - chloroplast trnC-D region
- ITS heuristic Maximum Parsimony analysis in PAUP*
- Distance-based phylogenetic analysis in SplitsTree

Results

Fig. 11 Specimen N43, collected near Sundance, WY, that was identified as *J. blancoi* by BLAST search.

Prior Reported Distribution

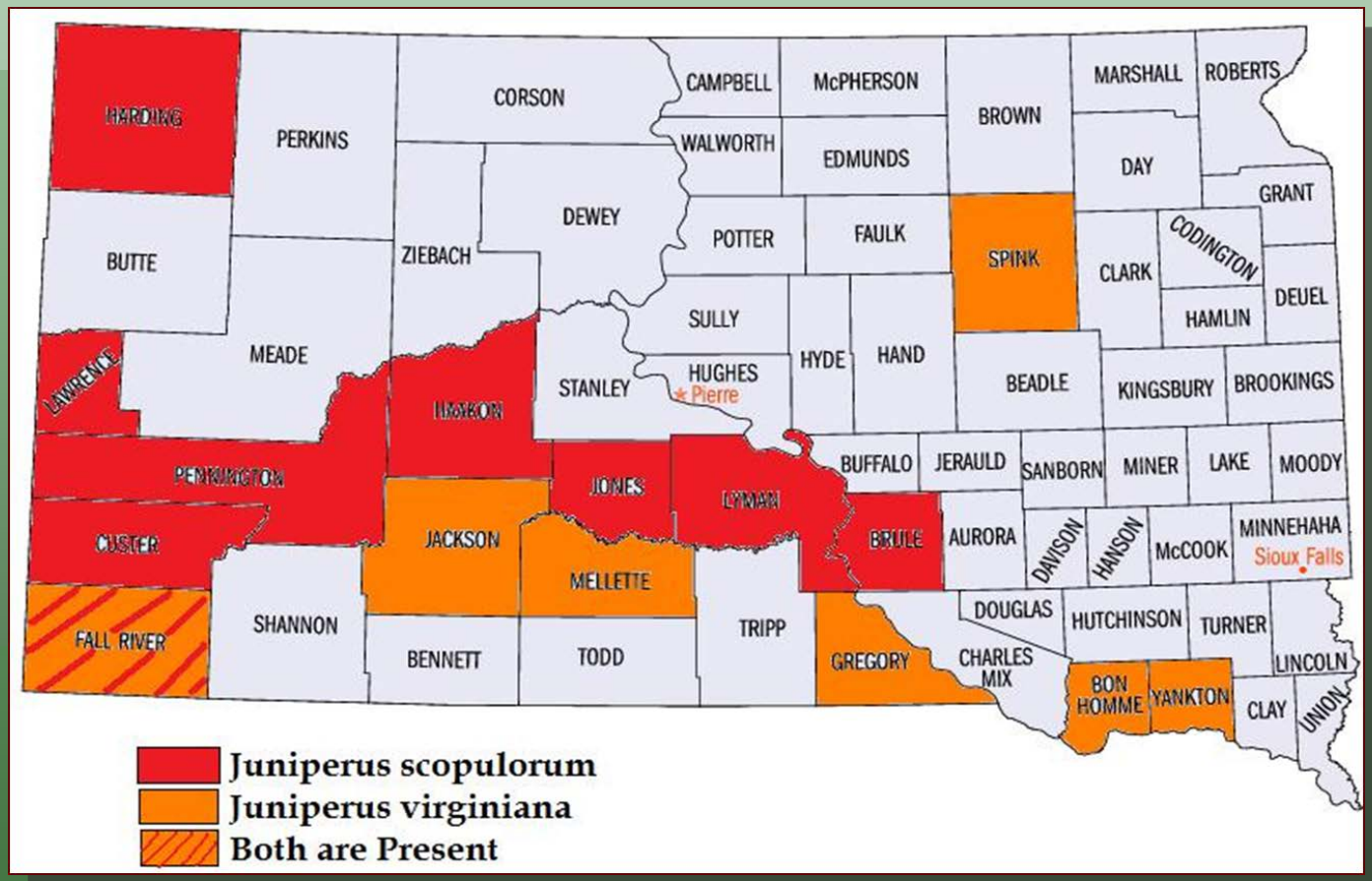

Fig. 12 Current distribution of *J. scopulorum* and *J. virginiana* in South Dakota according to Biota of North America Program.

Updated Current Distribution

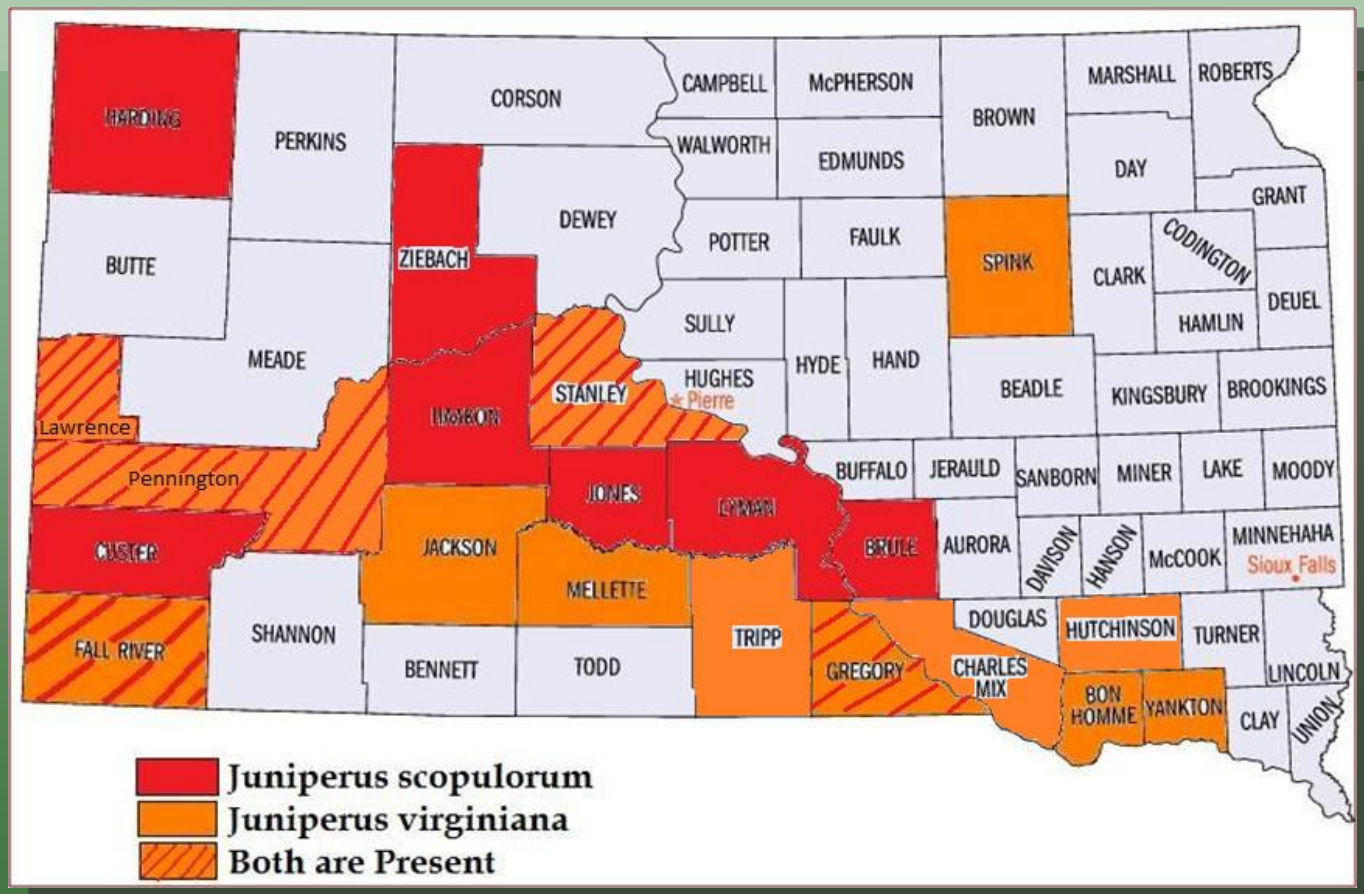

Fig. 14

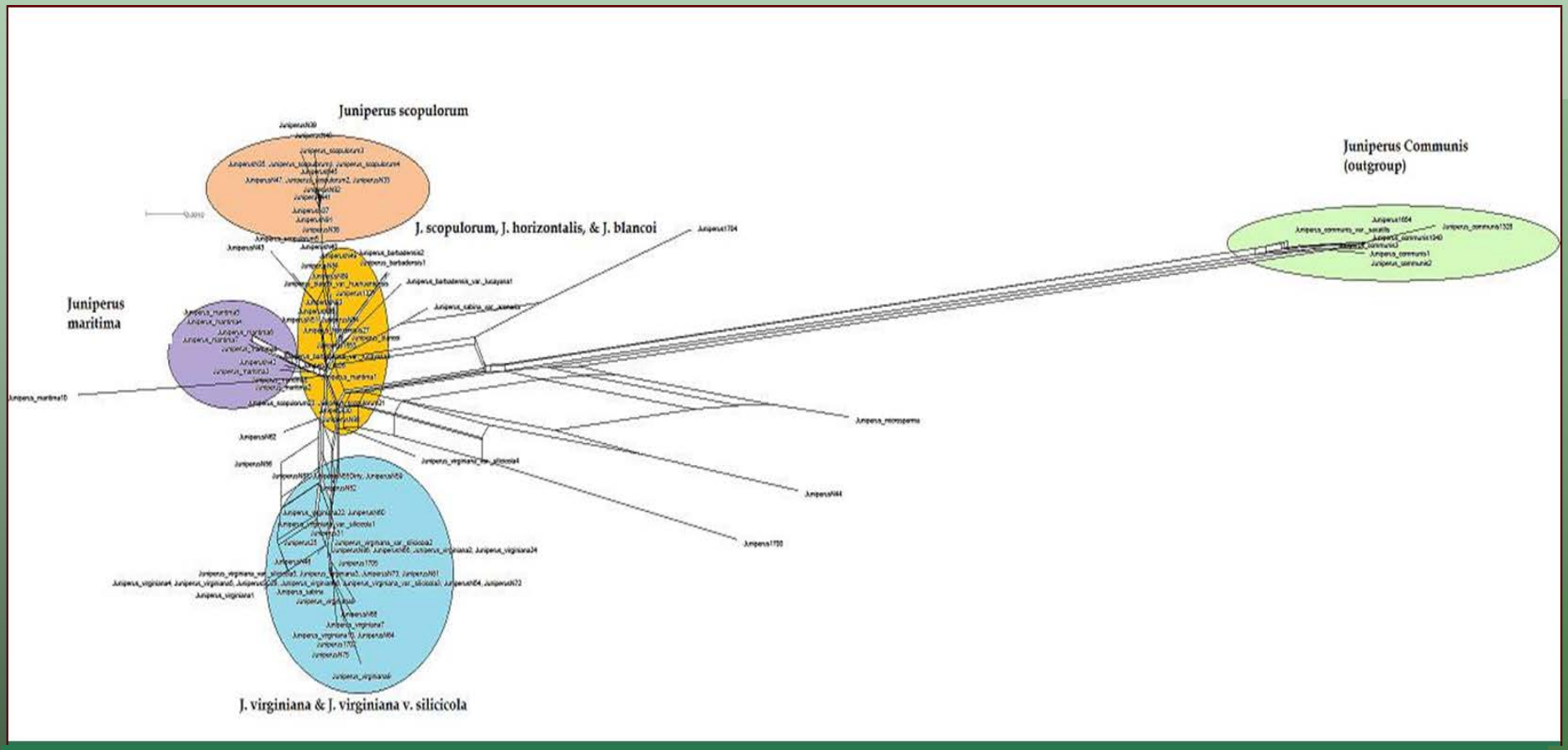

Fig. 15 Representation of the relationships between species of the genus *Juniperus* using the ITS region sequence data and the program SplitsTree v. 4.11.3 (Huson and Bryant 2006).

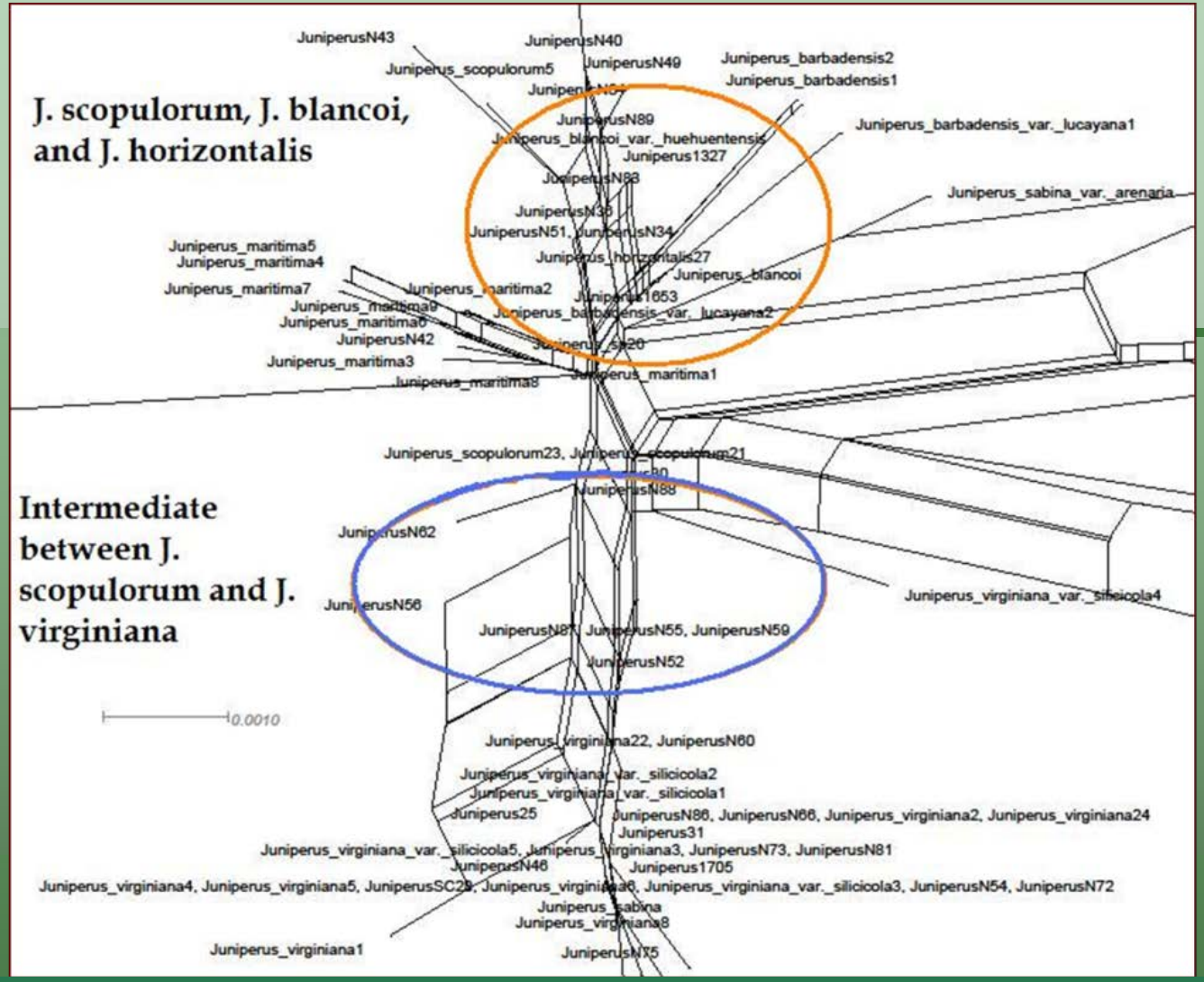

Fig. 16 The orange circle shows how closely *J. scopulorum, J. blancoi,* and *J. horizontalis* are to each other. The blue oval shows the specimens which are intermediate between *J. scopulorum* and *J. virginiana* according to their grouping and morphological characteristics.

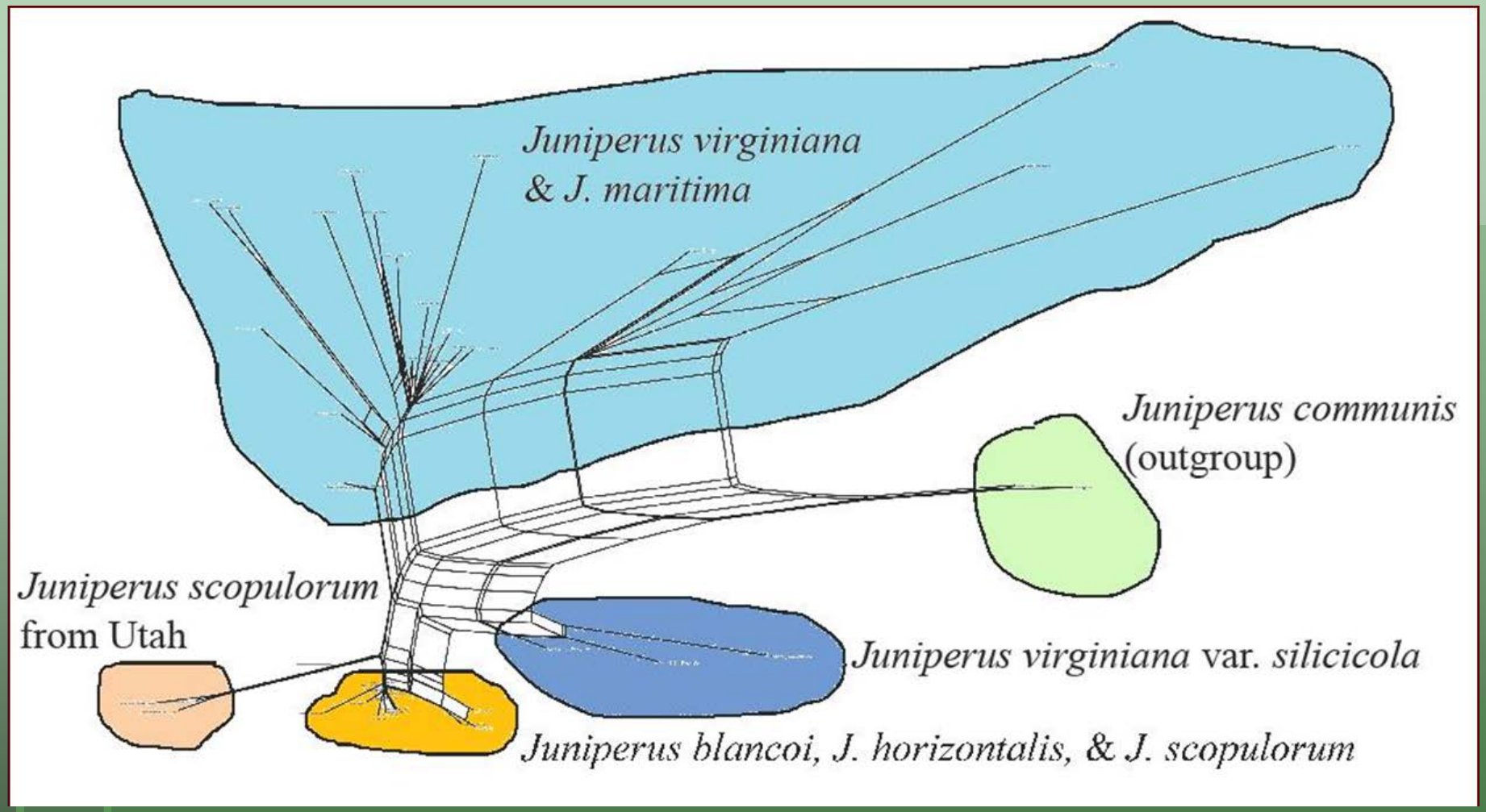

Fig. 17 This image represents the relationships between various species of the genus *Juniperus* using the trnC-D region and the program SplitsTree v. 4.11.3 (Huson and Bryant 2006).

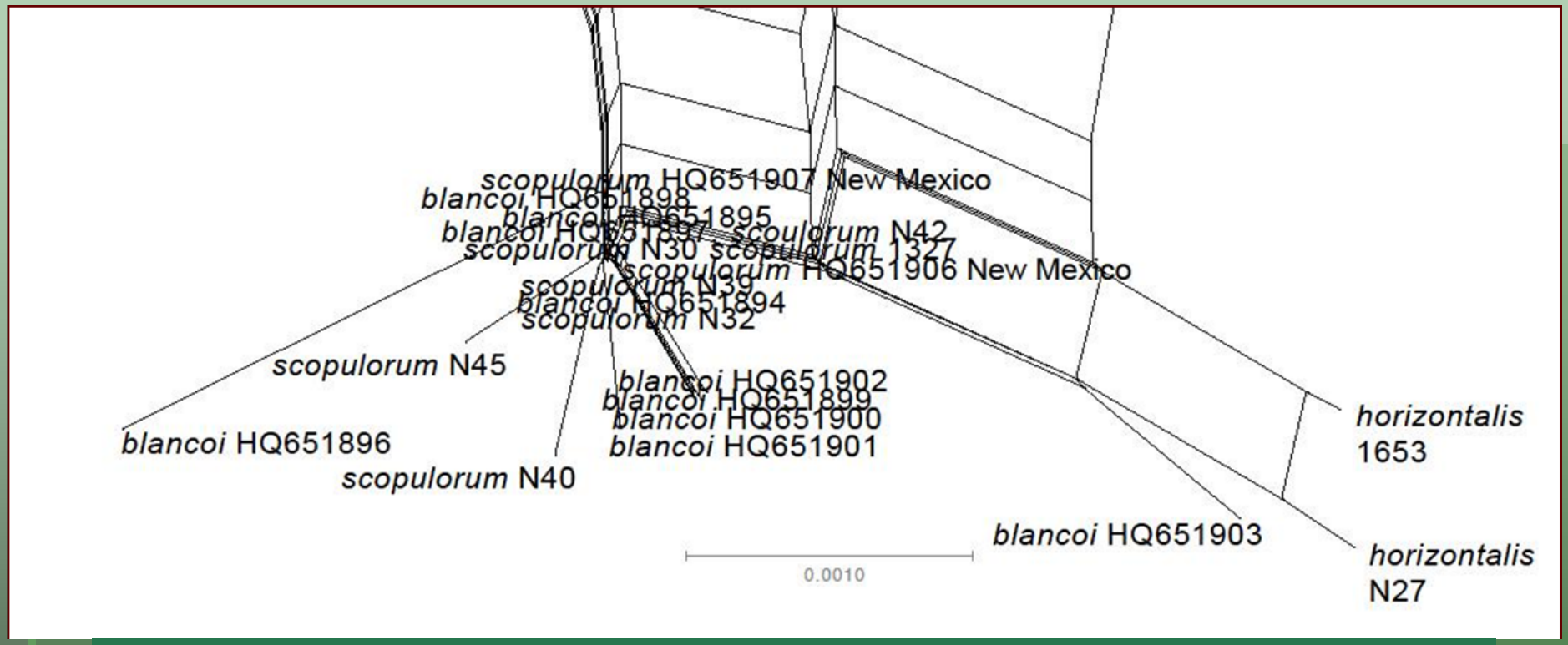

Fig. 9 This image shows how closely grouped our specimens are with *J. blancoi* and *J. scopulorum*.

trnC-D

Table 1. Shows the results of running the trnC-D sequences, which were then analyzed using PAUP.

Specimen	Morphology	Similarity-based
N27	J. horizontalis	J. scopulorum
N28	J. scopulorum	J. virginiana
N30	J. scopulorum	J. scopulorum / J. blancoi
N32	J. scopulorum	J. scopulorum / J. blancoi
N39	Indeterminate	J. scopulorum / J. blancoi
N40	J. virginiana	J. scopulorum / J. blancoi
N42	J. virginiana	J. scopulorum / J. blancoi
N45	J. virginiana	J. scopulorum
N60	Indeterminate	J. virginiana
N75	J. virginiana	J. virginiana

Further Study

- Analysis of *J. blancoi* and *J. scopulorum*
  - Terpenoid analysis
    - comparison of essential oils in leaf
    - Naphthalene
- Further DNA sequencing of *J. blancoi* and *J. scopulorum*

Works Cited

- Adams, Robert P., et. al. (2006). DNA fingerprinting and terpenoid analysis of *Juniperus blancoi* var. *huehuentensis* (Cupressaceae), a new subalpine variety from Durango, Mexico. *Biochemical Systematics and Ecology*. 34. 205-211. doi:10.1016/j.bse.005.11.004
- *Juniperus horizontalis*. (2011). The Gymnosperm Database. Editor Christopher J. Earle. Copyright 2011. Retrieved from http://conifers.org/cu/Juniperus_horizontalis.php
- Juniperus scopulorum. (2011). The Gymnosperm Database. Editor Christopher J. Earle. Copyright 2011. Retrieved from http://conifers.org/cu/Juniperus_scopulorum.php
- *Juniperus virginiana*. (2011). The Gymnosperm Database. Editor Christopher J. Earle. Copyright 2011. Retrieved from http://conifers.org/cu/Juniperus_virginiana.php
- Mao, K., Hao, G., Liu, J., Adams, R. P., & Milne, R. I. (2010). Diversification and biogeography of *Juniperus* (Cupressaceae): variable diversification rates and multiple intercontinental dispersals. *New Phytologist*. 188. 254-272. dio: 10.1111/j.1469-8137.2010.03351.x.

Conclusion

- Results Show Hybridization occurring
  - *J. scopulorum & J. virginiana*
- *J. horizontalis*
  - phylogenetically embedded within *J. scopulorum*
- *J. virginiana and J. scopulorum*
  - documented in new areas
- *J. blancoi* samples identity
  - inconclusive