

Speaking "Plant" for New Zealanders – Ecogene's plant diagnostic services.

Dagmar Goeke
Ecological Genetics Team, Lincoln



LANDCARE RESEARCH
MANAAKI WHENUA



The big picture

A commercial branch of **Landcare Research**:

- Molecular laboratories in Auckland and Lincoln
- Protect and enhance the terrestrial environment
- Grow New Zealand's prosperity
- But really we're just DNA geeks and we love riddles

Lincoln lab team of Ecogene - plants

Gary Houlston



Caroline Mitchell & Dagmar Goeke

- Biodiversity and Conservation



Carina Davis

- Ecosystems and Global Change



Katherine Trought

- Soils and Landscapes



Yellow bristle-grass



yellow foxtail, pigeon
grass

- *Setaria pumila*



- Origin: Southern Europe, but known throughout the world as a common weed, used as pasture grass and for cut fodder
- can cover 20 - 40 % of productive dairy farming pasture causing a loss in milk production¹⁾

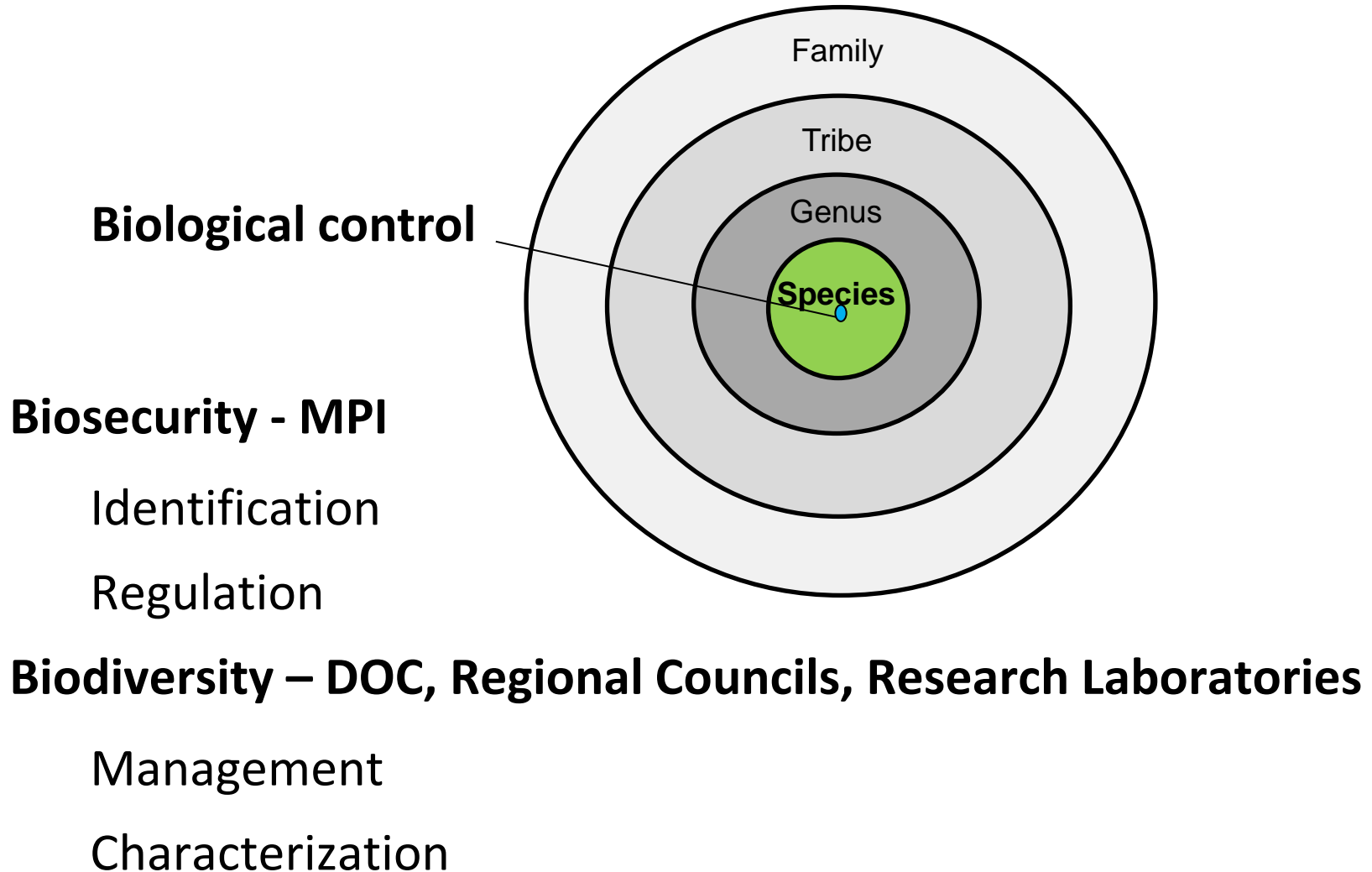
1) <http://www.agresearch.co.nz/our-science/biocontrol-biosecurity/weed-control/Pages/yellow-bristle-grass.aspx>

Yellow bristle-grass in NZ

- 632 samples received from AgResearch sampled all over New Zealand (21 sites)
- Another 15 samples from the Herbarium and from Regional Councils (plant ID service)
- **Biocontrol possible?**



Species are important!



What makes a species?

Species are usually defined by “concepts”:

Recent review found 24 different species concepts

(de Queiroz 2007 Syst. Biol. 56: 879-886)

‘The long discussion over the correct name of yellow bristle grass seems ‘to be resolved in favour of *S. pumila*...’

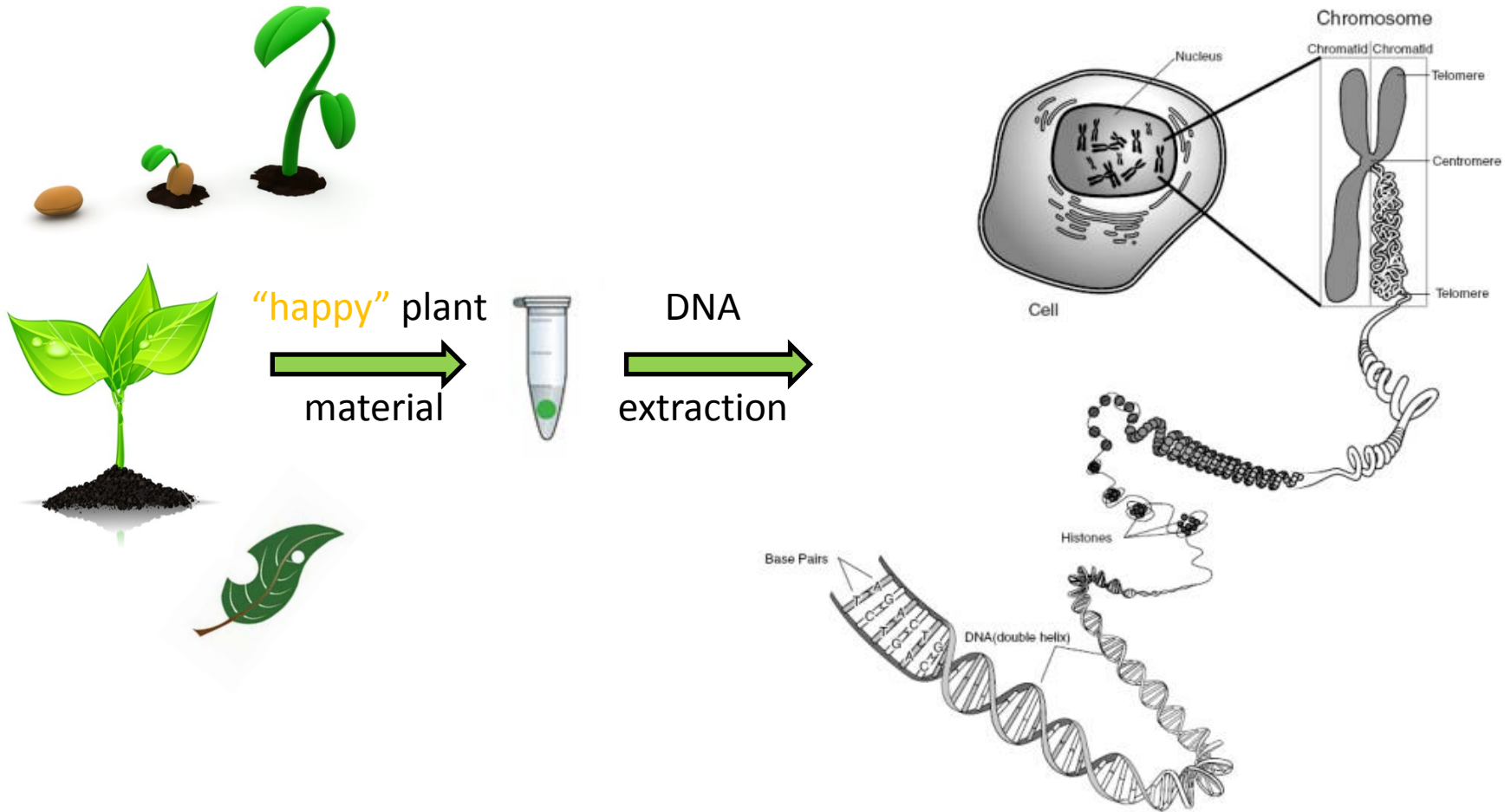
(Flora of New Zealand, Vol. V, grasses)

Systematists usually know what they mean, but it’s complicated...

Synonyms for *S. pumila*

Oplismenus helvolus (L.f.) P.Beauv.
Panicum flavescens Moench nom. illeg.
Panicum helvolum L.f.
Panicum holcoides J.Jacq. nom. illeg.
Panicum luteum Gueldenst. nom. inval.
Panicum pallidifusum Schumach.
Panicum pumilum Poir.
Panicum rubiginosum Steud.
Pennisetum helvolum (L.f.) R.Br.
Setaria auricoma Link ex A.Braun
Setaria boninensis Nakai nom. inval.
Setaria breviglumis St.-Lag.
Setaria dasyura Schlecht.
Setaria erythraeae Mattei
Setaria helvola (L.f.) Roem. & Schult.
Setaria laeta de Wit
Setaria pallide-fusca (Schumach.) Stapf & C.E. Hubb.
Setaria pallidifusca (Schumach.) Stapf & C.E.Hubb.
Setaria rubiginosa (Steud.) Miq.
Setaria sciuroidea C.Muell.
Setaria ustilata de Wit

DNA extraction



"happy" = healthy / well dried / fresh plant material

Genotyping = fingerprinting

For very closely related species:
AFLP (Amplified Fragment Length Polymorphism)

Sites 1-4

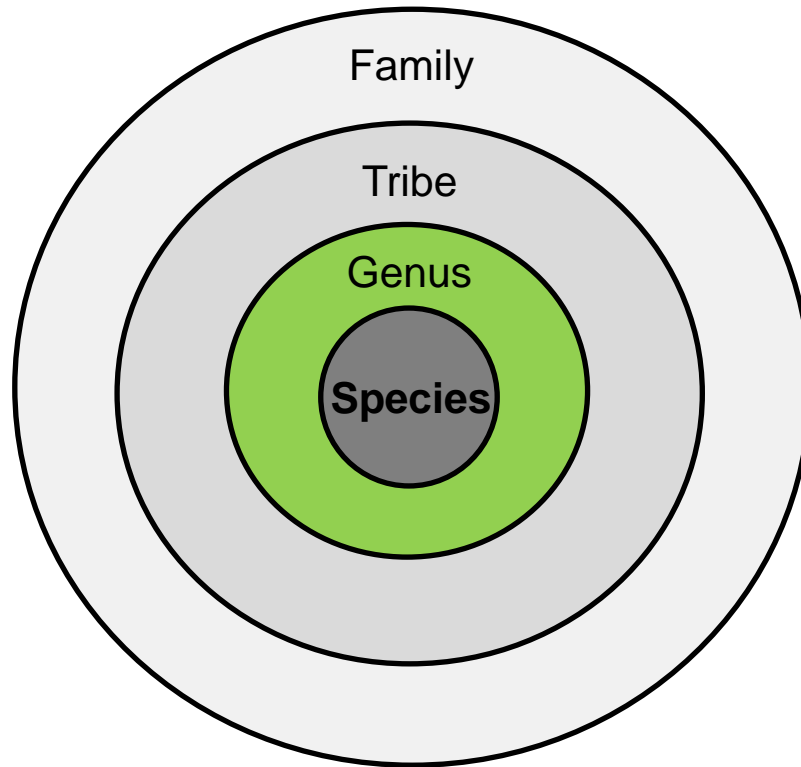
Sites 5-10,12

Site 11

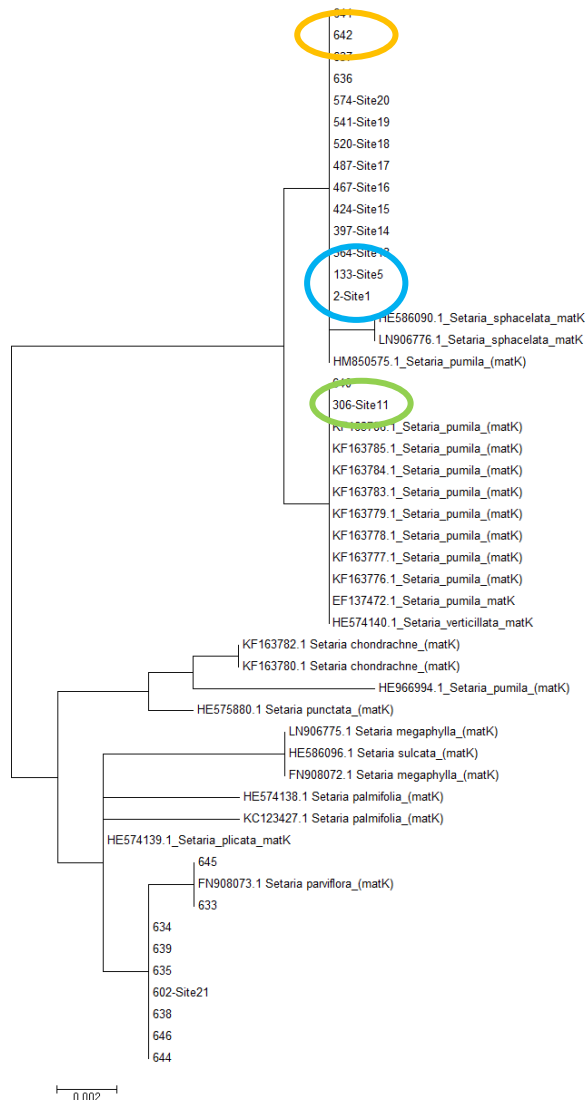
Site 11



Yellow bristle grass



Setaria – cp sequencing data



642 – cultivated *S. sphacelata*
from a trial in 1970s

A

S. pumila or
S. sphacelata?

- invasive

B

S. pumila variant B or
S. verticillata?

C

S. parviflora

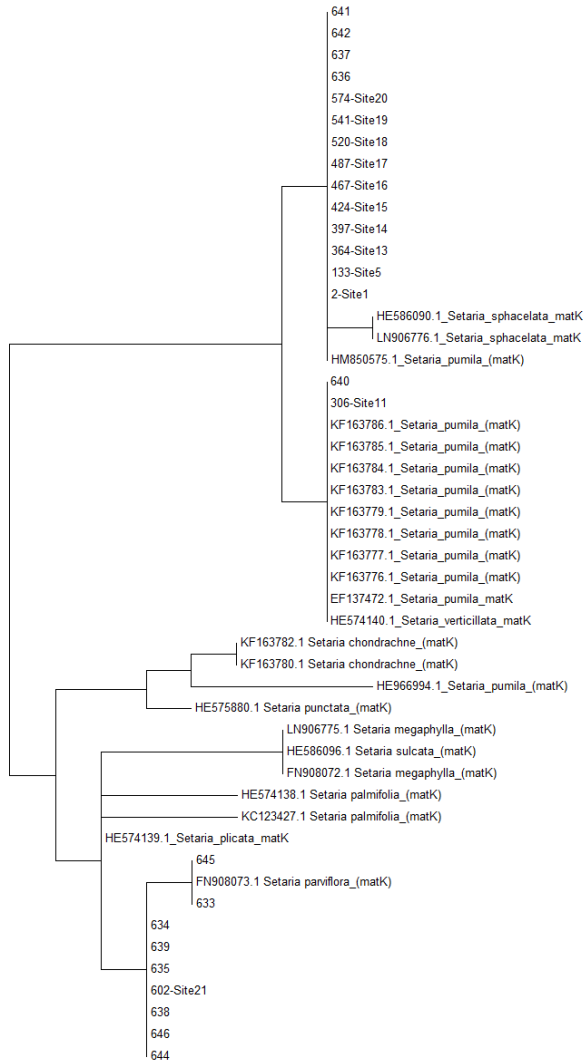
D

S. gracilis? – changes due in NZ

Other *Setaria* species

- **Group A** '*Setaria sphacelata* - native to tropical and subtropical Africa, and is extensively cultivated globally as a pasture grass and for cut fodder.'
- **Group B** '*Setaria verticillata* - native to Europe, but it is known on most continents as an introduced species and often a noxious weed.'
- **Group C** '*Setaria parviflora* - native to North America, including Mexico and the United States from California to the East Coast, Central America and the West Indies, and South America.'
- **Group D** ???

Setaria entities in NZ



A - invasive

- Cp data maternal origin

B

- Who's Dad?

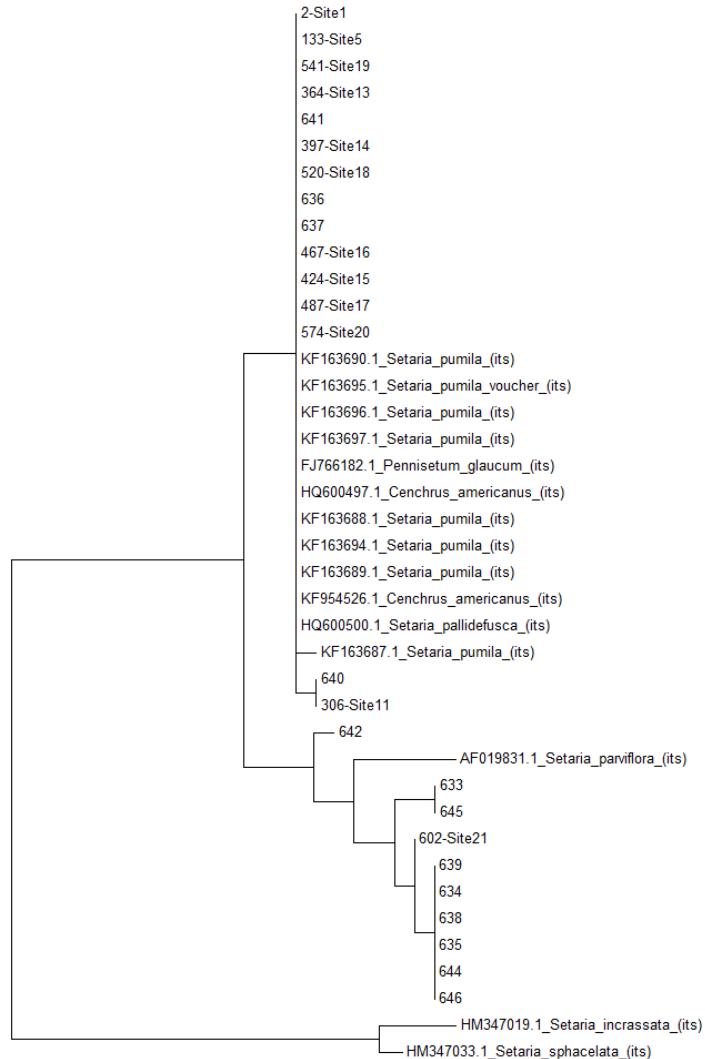
– sequencing of a nuclear ribosomal gene region

C

D

0.002

Setaria – nuclear sequencing data



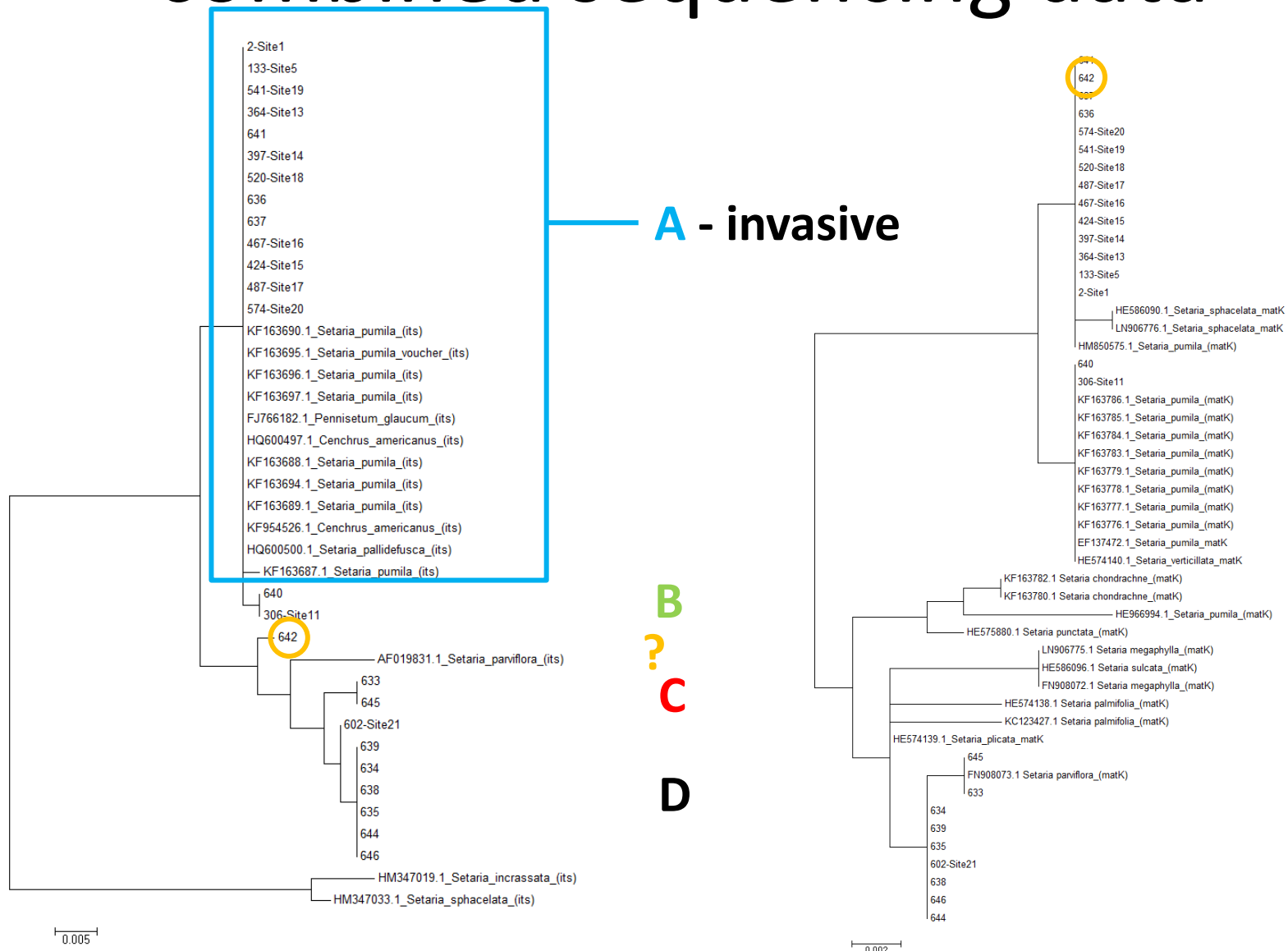
A - invasive

B

C

D

combined sequencing data



Now what???

Future planning to identify if biological control is possible:

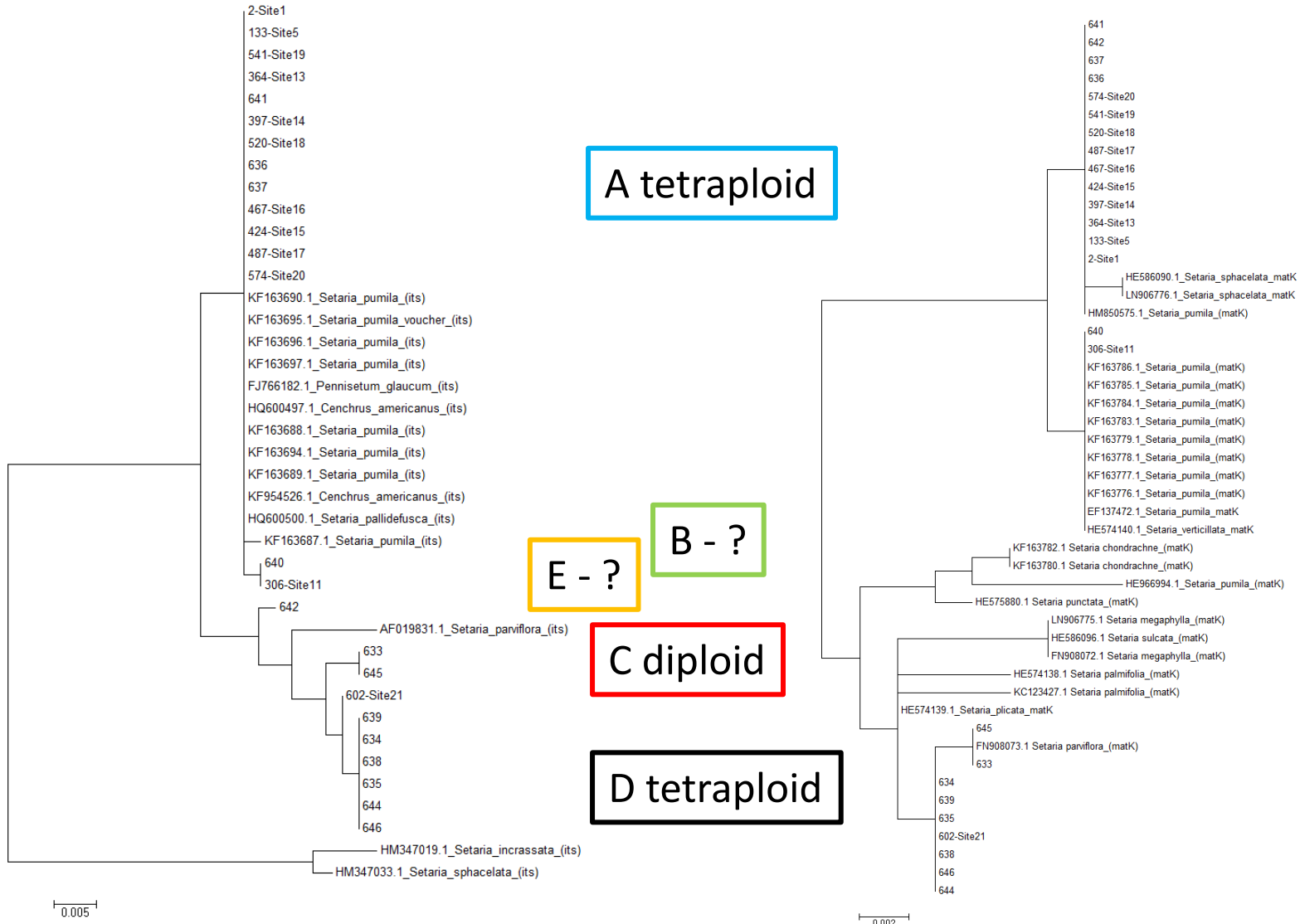
- Selected sampling
 - to identify number of entities present in New Zealand
 - to clarify relatedness within
- Clean reference specimens
- More gene regions for sequencing
- Include international specimens to determine origin(s)

Polyploidy in plants

- ~70 % of plants with polyploid histories
(D. A. Levin 2002)
- Biosecurity – how many of our worst weeds are from these sorts of groups?
- How often is chromosome number checked with taxonomic work?



Setaria – ploidy data



Molecular techniques services

- **DNA extraction** and quantitation
- **DNA sequencing**
- **Plant genus / species identification** using sequencing and genotyping / fingerprinting
- **Ploidy determination** using Flow Cytometry
- **Genome sizing** using Flow Cytometry



Limitations

- Available existing sequencing data from GenBank
- Reference material provided or available from NZ Herbaria
- Sample quality



You have a riddle?

Have a chat to us!!!



Main Contacts

Dr Gary Houlston, Plant Science Advisor,
EcoGene, Lincoln

Dr Frank Molina, Manager,
EcoGene, Tamaki/Auckland

Dr Ines Schonberger, Manager,
Allan Herbarium, Landcare Research, Lincoln



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