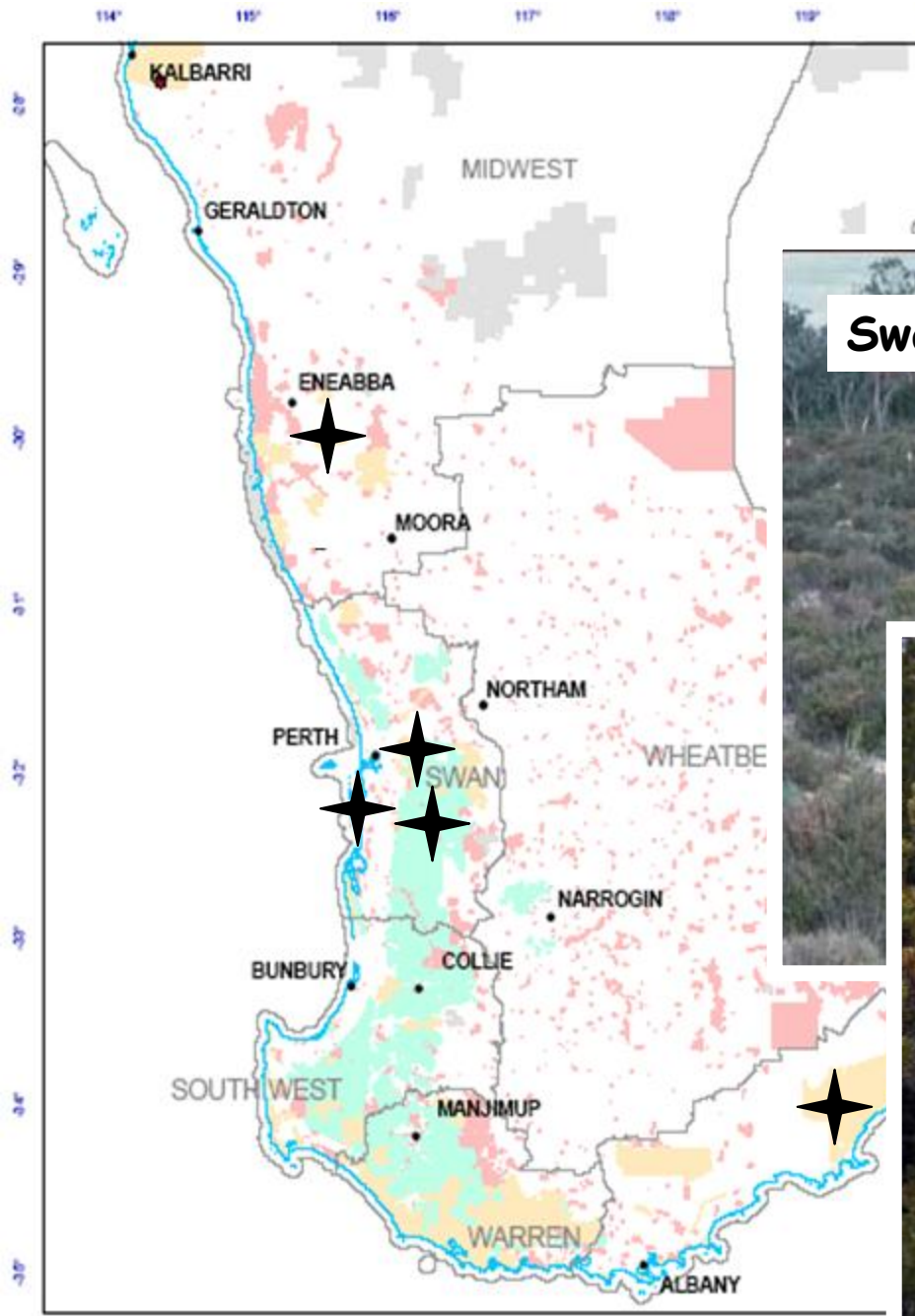


Molecular re-evaluation of *Phytophthora* species isolated during 30 years of vegetation health surveys in Western Australia

*Mike Stukely, Giles Hardy, Dianne White, Janet Webster,
Juanita Ciampini and Treena Burgess*





Northern sand plain



Swan Coastal Plain



Fitzgerald National Park

Coordinates shown at 1 degree intervals
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Impact of *Phytophthora cinnamomi* on plant species in Western Australia

Direct Impacts

- Out of 5710 described species in the South-West Botanical Province
- 2285 species susceptible (40%)
- 800 highly susceptible (14%)

Indirect Impacts

- Loss of biomass
- Loss of litter
- Loss of refugia for fauna
- Loss of food resources
- Increased exposure
- Loss of pollinators
- Loss of nesting sites

Phytophthora is listed as a 'KEY THREATENING PROCESS' to Australia's Biodiversity by Commonwealth Government

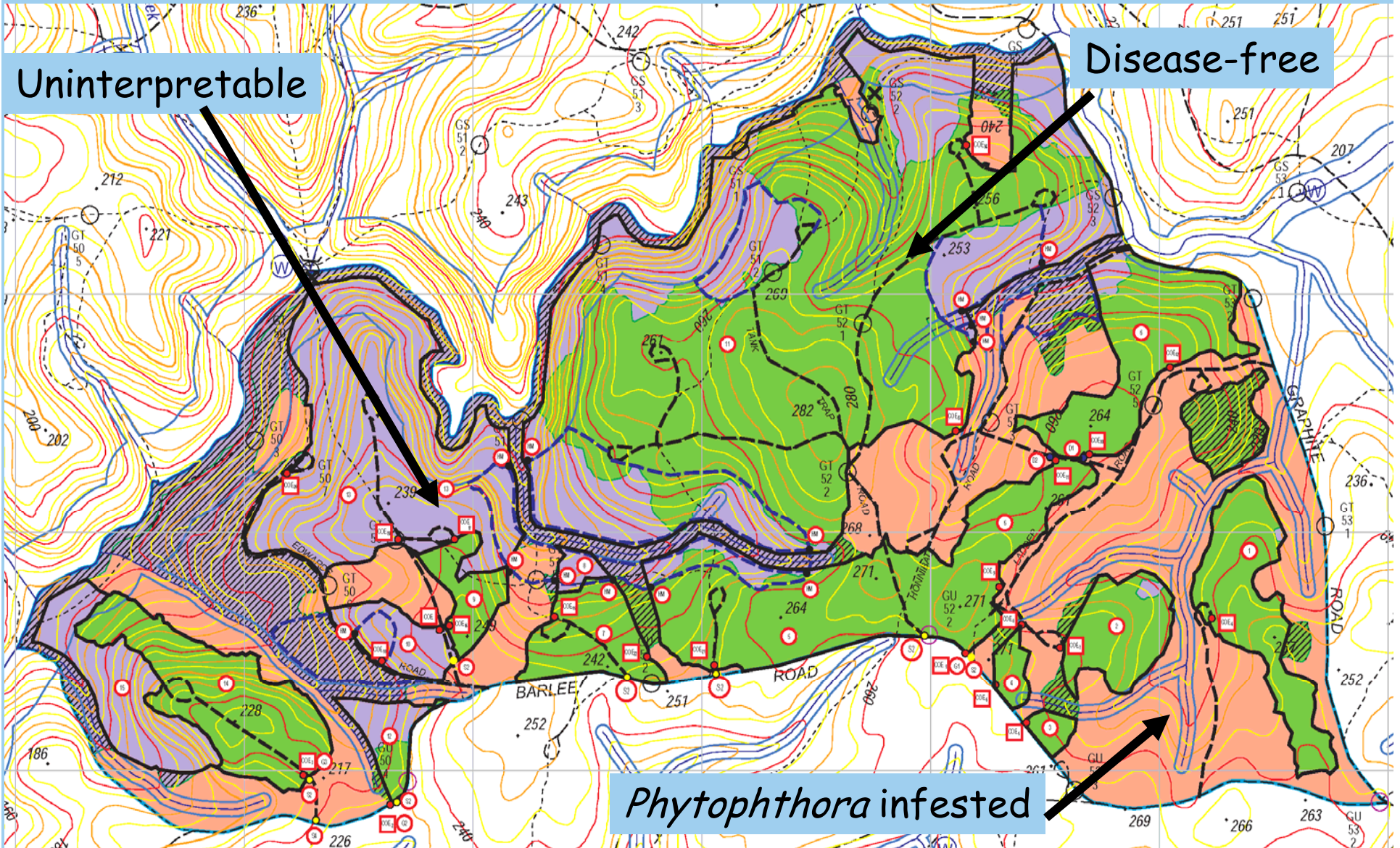


Dieback mapping and vegetative health surveys

- For over 30 years aerial photography has been used to map the extent of disease in WA
- Many areas are uninterpretable aerially and 'Dieback Interpreters' are sent in to ground truth
- They are trained to recognise susceptible indicator species. First indication of the presence of *P. cinnamomi* is the death of susceptible indicator species from the families Proteaceae, Epacridaceae, Dilleniaceae, Xanthorrhoeaceae, Fabaceae.
- Usually ground truth areas of native vegetation due to be logged
- Samples are taken (usually soil from rhizosphere of dying plants) and sent to vegetation health service (VHS)
- Soils are baited with cotyledons of *Eucalyptus sieberi*
- After 5(-10) days cotyledons are examined and plated onto selective media
- About 15% of phytophthora isolates are not *P. cinnamomi*



Phytophthora Management Map



Green = Dieback free; **Purple** = Uninterpretable; **Red** = Infested

Phytophthora species in natural ecosystems in WA

- Until recently identified only by morphological features

P. citricola

P. megasperma

P. cryptogea

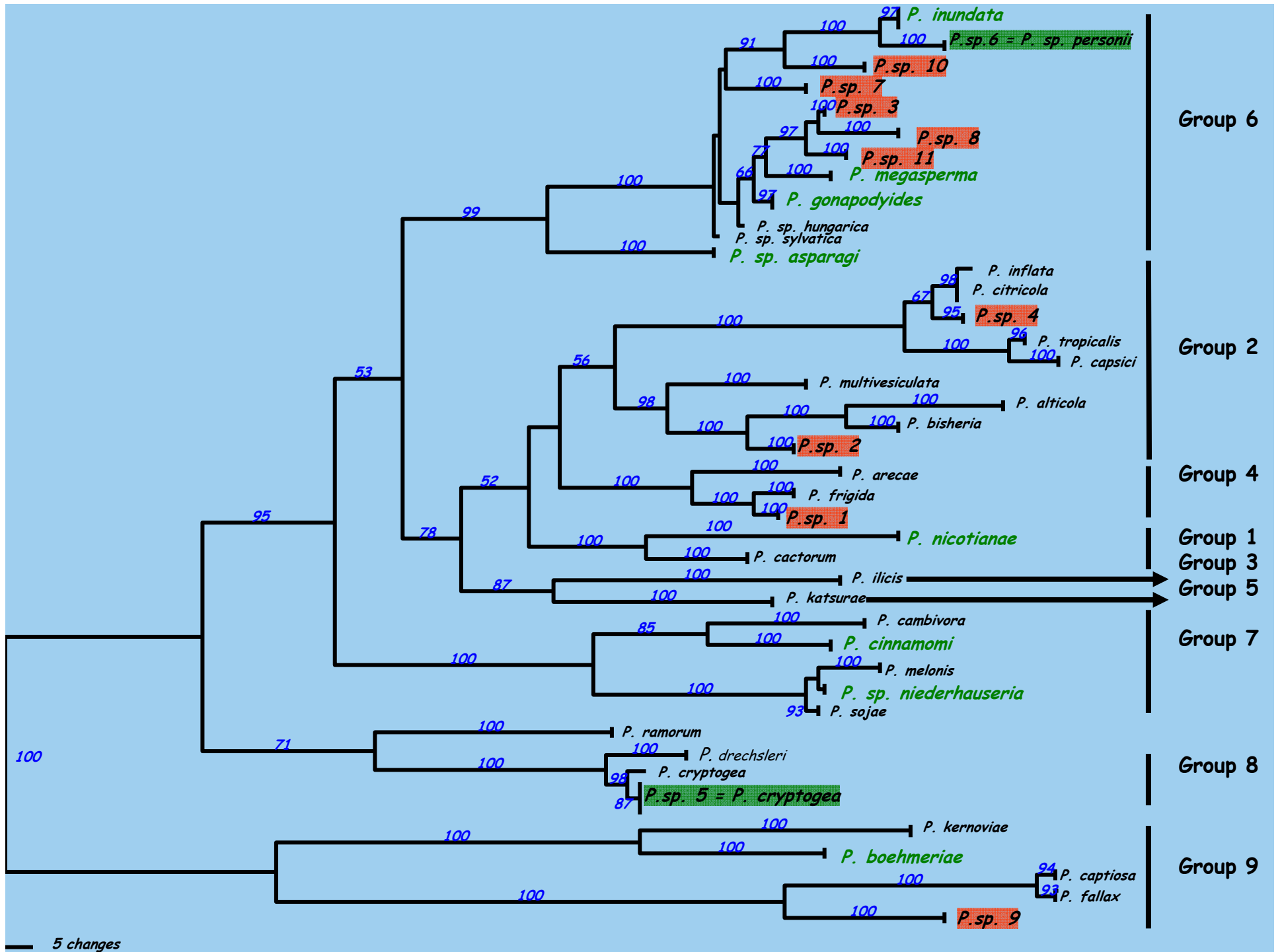
P. drechsleri

P. nicotianae

P. boehmeriae

- Other species are found in nurseries and in horticulture
- Over the past 2 years we have been conducting a molecular re-evaluation of *Phytophthora* spp. in natural ecosystems in WA
- Over 250 isolates so far examined
- Sequenced ITS region and constructed molecular phylogeny





Group 6

Group 2

Group 4

Group 1

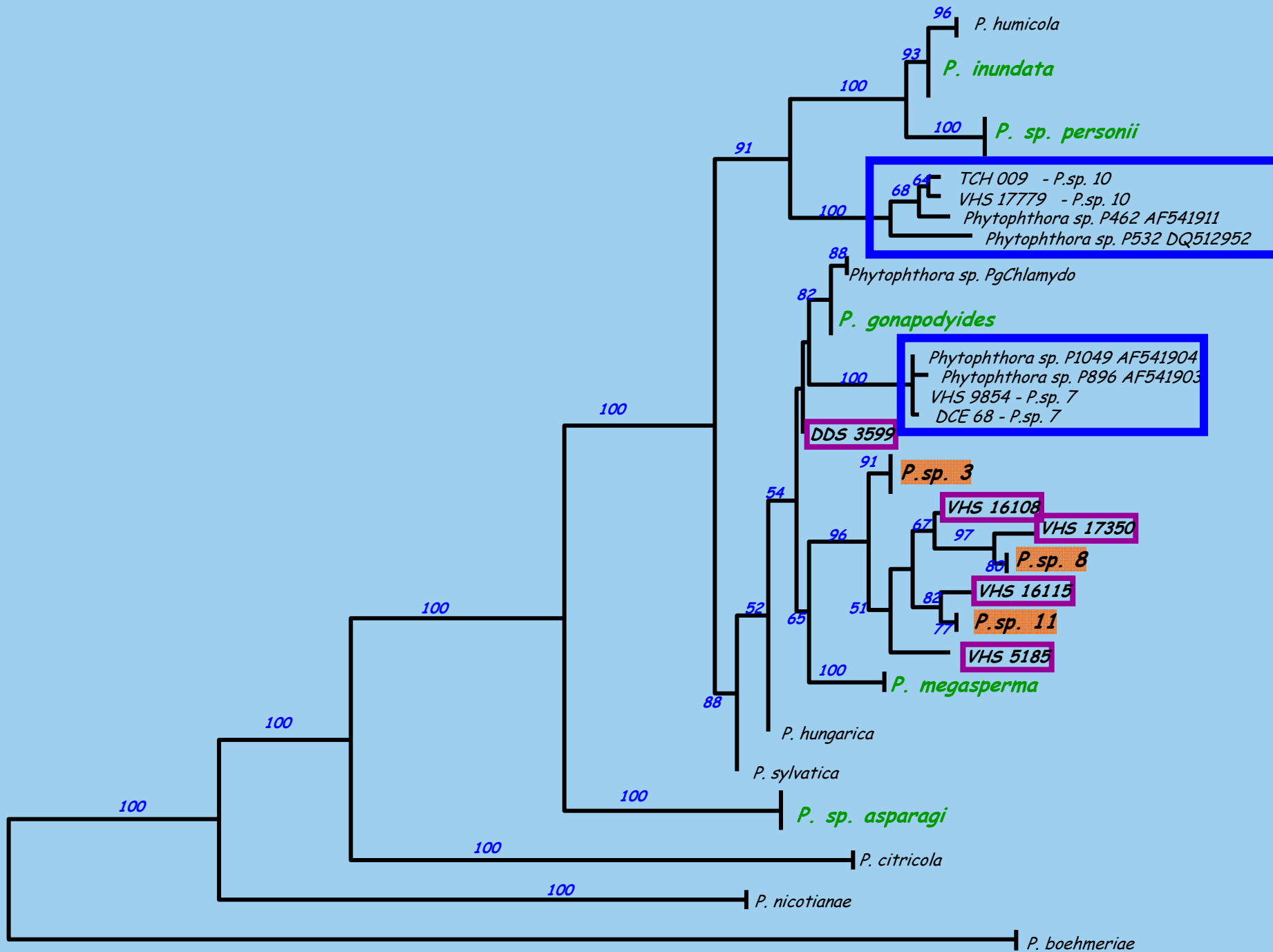
Group 3

Group 5

Group 7

Group 8

Group 9



— 5 changes

Often the morphological and molecular identifications do not match

Isolates	Morphology	DNA
Many	<i>P. citricola</i>	P.sp.4
Many	<i>P. citricola</i>	P.sp.2
All tested	<i>P. drechsleri</i>	P.sp.3/8
Two	<i>P. megasperma</i>	P.sp.7
Many	<i>P. megasperma</i>	P.sp.9
TCH009	<i>P. megasperma</i> var <i>sojae</i>	P.sp.10
VHS17183	<i>P. megasperma</i>	<i>P. megasperma</i>
All tested	<i>P. nicotianae</i>	<i>P. nicotianae</i>
All tested	<i>P. cinnamomi</i>	<i>P. cinnamomi</i>
All Tested	<i>P. cryptogea</i>	<i>P. cryptogea</i>



Phytophthora species in natural ecosystems in WA

- New records for WA

P. inundata

P. gonapodyides

P. sp. asparagi

P. sp. niederhauseria

P. sp. personii

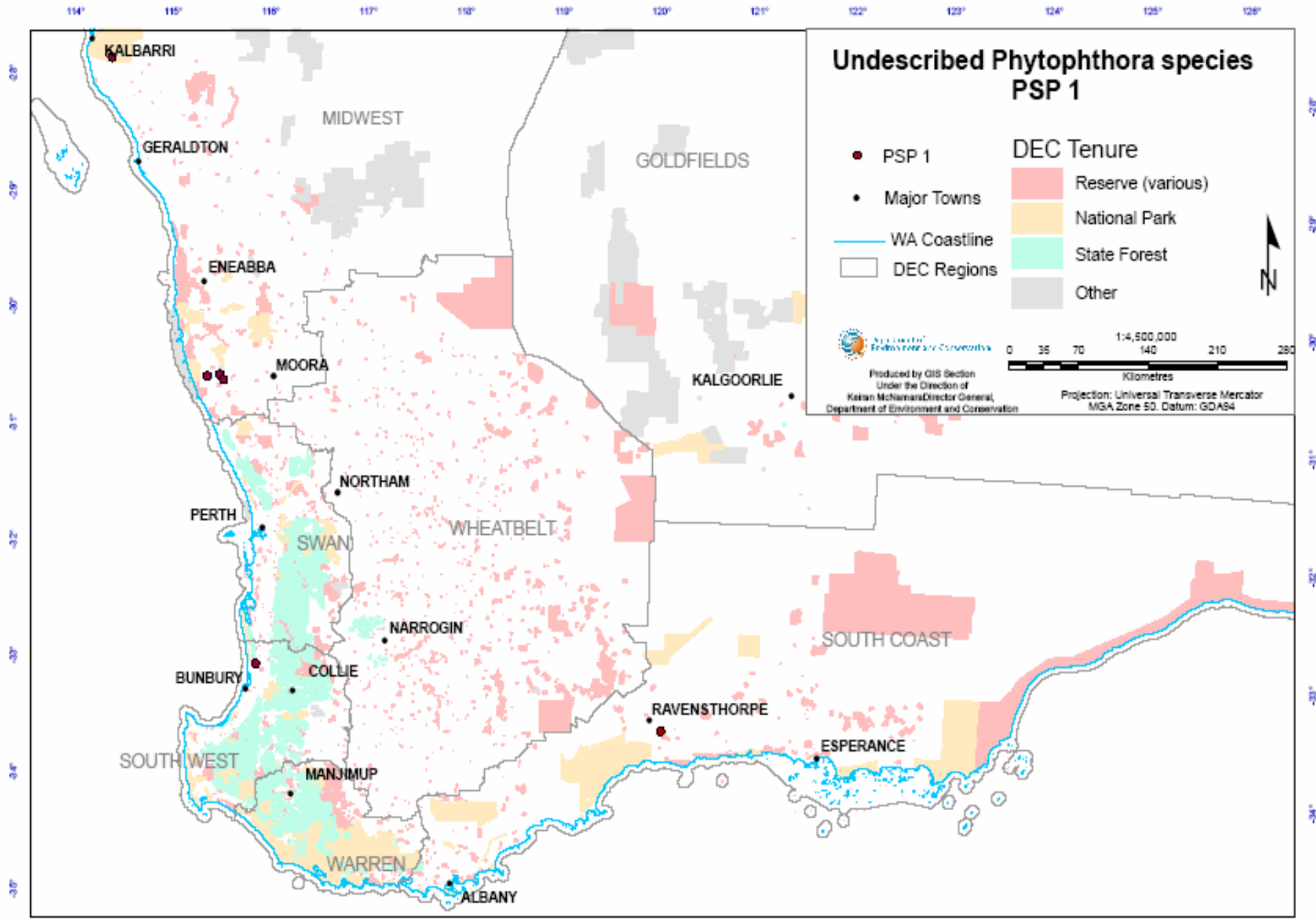
- At least seven new *Phytophthora* species which are genetically distinct to currently described species



Phytophthora species in natural ecosystems in WA

Species	No.	Host species
P. sp. 1	10	<i>B. menziesii</i> , <i>B. littoralis</i> , <i>B. attenuata</i> , <i>B. media</i>
P. sp. 2	21	<i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i> , <i>B. grandis</i> , <i>Dryandra squarrosa</i> , <i>Patersonia xanthina</i>
P. sp. 3	15	<i>E. marginata</i> , <i>B. attenuata</i> , <i>B. grandis</i> ; <i>Pinus radiata</i> (plantation)
P. sp. 4	64	<i>E. marginata</i> , <i>B. attenuata</i> , <i>B. grandis</i> , <i>B. littoralis</i> , <i>B. menziesii</i> , <i>B. prionotes</i> , <i>Conospermum</i> sp., <i>Leucopogon verticillatus</i> , <i>X. gracilis</i> , <i>Podocarpus drouyniana</i> , <i>Patersonia</i> sp., <i>Bossiaea</i> sp., <i>Gastrolobium spinosum</i> ; <i>Pinus radiata</i> (plantation)
P. sp. 7	4	<i>X. preissii</i> , <i>Pinus radiata</i> (plantation)
P. sp. 8	3	Soil and water baits - native forest
P. sp. 9	23	<i>B. attenuata</i> , <i>B. baxteri</i> , <i>D. cirsioides</i> , <i>D. falcata</i> , <i>A. cuneata</i> , <i>Isopogon</i> sp.; <i>Pinus radiata</i> (plantation)
P. sp. 10	2	<i>B. prionotes</i> , <i>B. grandis</i>
P. sp. 11	2	<i>Banksia</i> sp., <i>X. preissii</i>

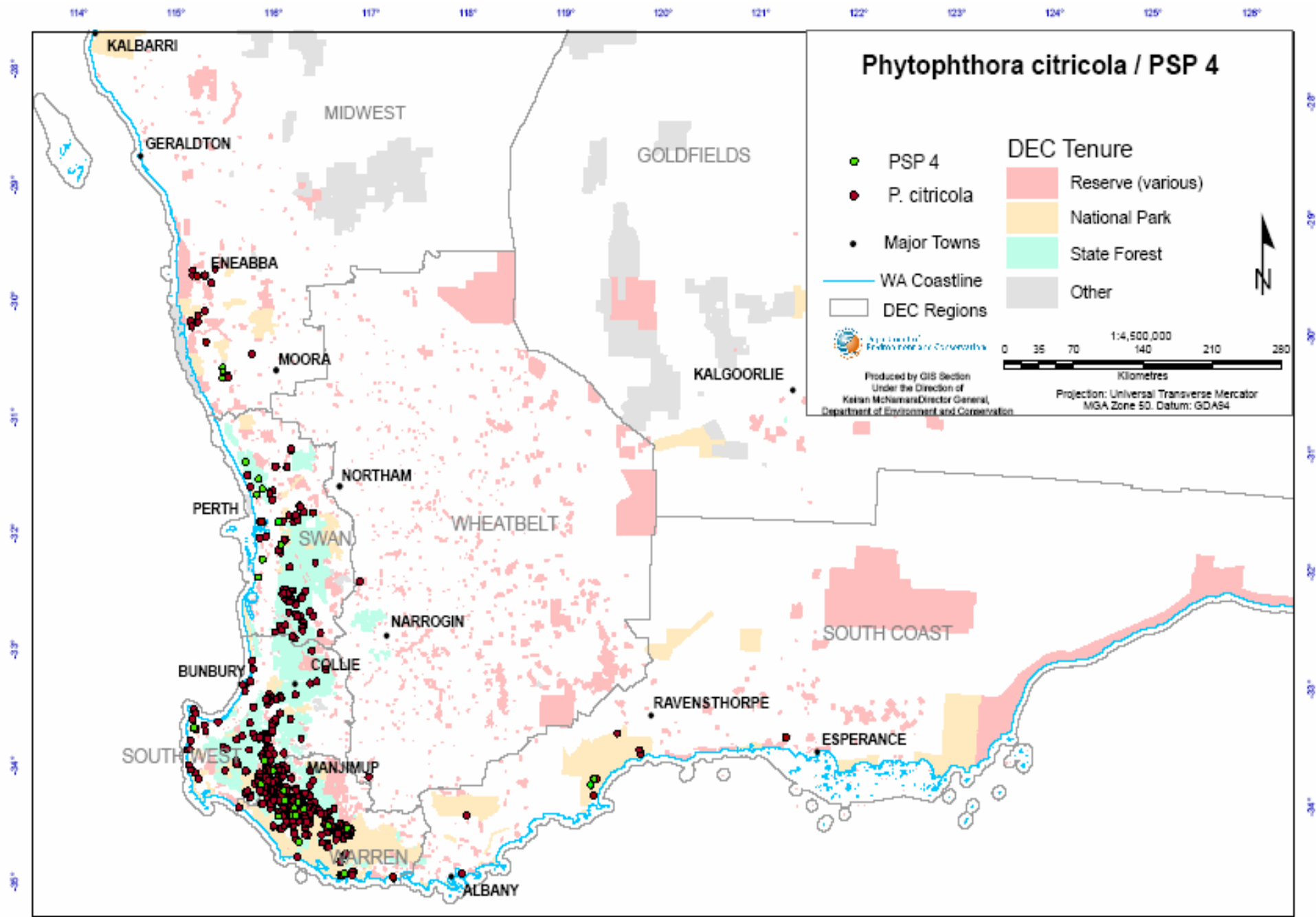




Gridlines shown at 1 degree intervals

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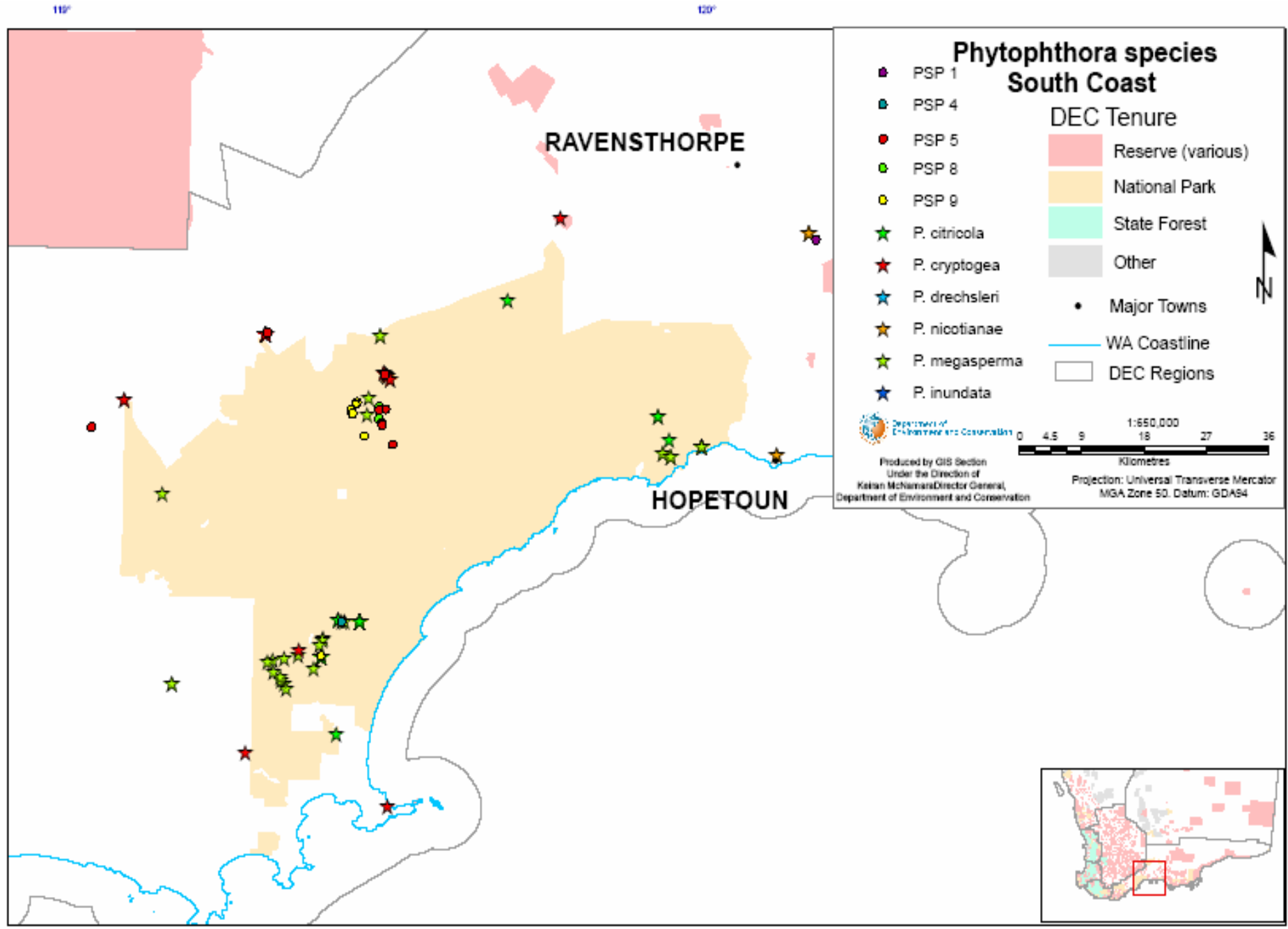
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114° 115° 116° 117° 118° 119° 120° 121° 122° 123° 124° 125° 126° 127°
 Longitude shown at 1 degree intervals

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119°
 34°
 Gridlines shown at 1 degree intervals

120°
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Significance of new phytophthora species

- Do they pose a threat to biodiversity?
- If yes, then management strategies will be developed
- Need to investigate
host range/pathogenicity
distribution
factors affecting spread
- Are these species introduced?
- Are any of these species hybrids?





