Pests and Climate change

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GNS SCIENCE

Pests and climate change

Climate is one of the major factors limiting the distribution of plants and cold-blooded animals.

Climate change is therefore expected to change the distribution of current pests, and

Climate change my make NZ more suitable to external threats

Climex

Using climate information CLIMEX enables you to assess the risk of a pest establishing in a new location and the potential success or failure of a biological control agent with no knowledge of the species, except for knowing the current locations they do occur.

CLIMEX helps you understand the impact of climate change on species distribution and the potential risk from invasive species to an agricultural region.

Ecoclimatic index (EI)

- The Ecoclimatic Index (EI) integrates the Annual Growth Index (GIA), which **describes the potential for population growth, with the annual stresses that limit survival during the unfavourable season and with any limiting factors**, ie PDD, diapause.
- As few climates are 100% suitable throughout the year, the value of GIA rarely reaches its potential, thereby limiting the maximum value of EI. The EI thus gives an overall measure of the potential of a given location to support a permanent population.
- The EI is scaled between 0 and 100, with an **EI close to 0 indicating that the location is not favourable** for the long-term survival of the species.
- An EI of more than 30 represents a very favourable climate for a species, as it means that during the (say) six months suitable for growth, the species has achieved 60% of the potential population growth. Limiting factor are daily fluctuating temperatures and the likely absence of continuous optimal rainfall values.
- Sutherst, Maywald and Skarratt 1995

Representative Pests

Pest	Sector or Impact	Pest	Sector or Impact	Pest	Sector or impact
Acantholybas brunneus		Alternanthera philoxeroides Alligator Weed	Waterways Invasive	Amorbus robustus Clown bug	
Anastrepha obliqua West Indian fruit	Hort	Asparagus aethiopicus Bushy Asparagus	Indig Invasive	Baccharis halimifolia Groundsel Bush	Agriculture
Bactrocera correcta Guava Fruit fly	Hort	Ceratitis rosa Natal fruit fly	Hort	Hypericum tetrapterum St. Peter's wort	Wetlands
Bactrocera cucumis Cucumber fruit fly	Hort	Cerotoma trifurcate Bean leaf beetle	Hort	Lantana camara	Indigenous
Bactrocera cucurbitae Melon fly	Hort	Clematis vitalba Old Man's beard	Indigenous Invasive	Latrodectus hasseltii Redback spider	
Bactrocera dorsalis Oriental fruit fly	Hort	Cortaderia selloana Pampas grass	Forestry	Lymantria dispar Gypsy moth	Forestry
Bactrocera musae Banana fly	Hort	Cytisus scoparius Broom	Forestry	Lythrum salicaria purple loosestrife	Wetlands
Bactrocera neohumeralis	Hort	Dothistroma spp Fungi	Forestry	Melaleuca quinquenervia Paper bark tree	Forestry Indigenous

Representative pests …

Bactrocera tryoni Queensland Fruit Fly	Hort	Essigella californica Monterey pine aphid	Forestry	Nassella neesiana Chilean needle grass	Agriculture
Bactrocera zonata Peach fruit fly	Hort	Fusarium circinatum Pitch Canker	Forestry	Passiflora tripartite Banana passionfruit	Forestry Indigenous
Buddleja davidii Butterfly bush	Forestry Indigenous	Gymnocoronis spilanthoides Senegal tea plant	Wetlands	Pennisetum clandestinum kikuyu grass	Agriculture
Rhagoletis indifferens Western Cherry fruit fly	Fruit Fly	Sirex noctilio Sirex Woodwasp	Forestry	Solenopsis Invicta Red Imported Fire Ant	
Thaumastocoris peregrinus Bronze bug	Forestry (Eucalypts)	Thaumetopoea pityocampa Pine processionary moth	Forestry	Thrips palmi Melon thrips	Hort
Uraba ludens Gum leaf skeletoniser (moth)	Forestry (Eucalypts)				

Analyses

Niwa supplied climate data, from **6 regional climate models** at **4 different levels of CO2** (RCP - Representative concentration pathways)

Data is on a 5km grid (0.05 degrees)

Two analyses

1) Each species is modelled at 5 yrs intervals (2015 – 2120), for each RCM and RCP, capturing the inter-annual variation in potential distribution. (40*20*6*4 = 19,200 data sets)

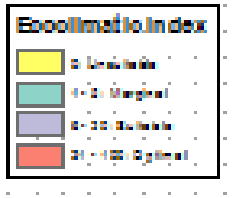
2) 20 year normal data centred on 2005, 2050, 2090, for each species, RCM and RCP.

This data was reduced by using the maximum EI for each cell from each RCM.

Groundsel Bush - Baccharis halimfolia

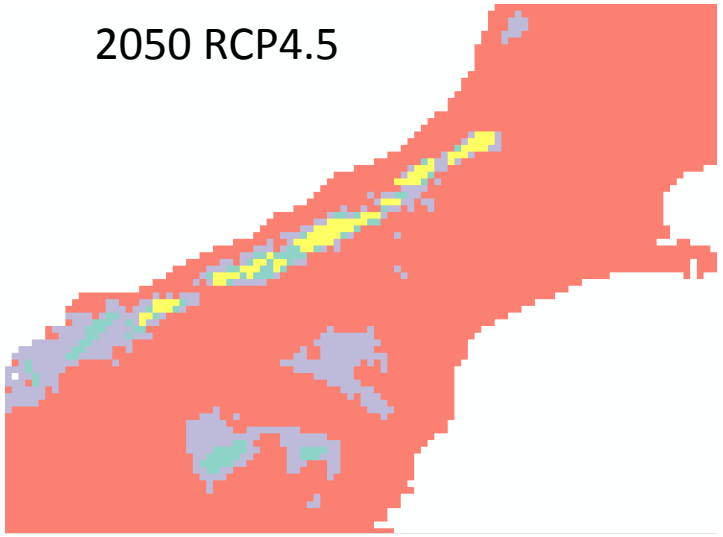
- Groundsel bush is a serious weed of horticulture, cropping and grazing agricultural industries as well as forestry, as it readily invades open to densely vegetated forests and agricultural
- It can inhibit the movement of stock and reduce the productivity and carrying capacity of agricultural land.
- Groundsel bush will cause livestock will lose condition rapidly if forced to graze it.
- Groundsel bush is particularly invasive in some specific situations:
  - badly-drained, poor, coastal wetlands;
  - areas where groundcover has been disturbed;
  - all grazing land that is overgrazed or under vegetated – newly-cleared land is prone to invasion, as is land which has suffered from fertility rundown and neglect;
  - open or poorly-developed forest areas after logging when canopy cover is reduced and soil disturbance is at a maximum;
  - occasionally, even in dense pasture.

Groundsel Bush - Baccharis halimfolia

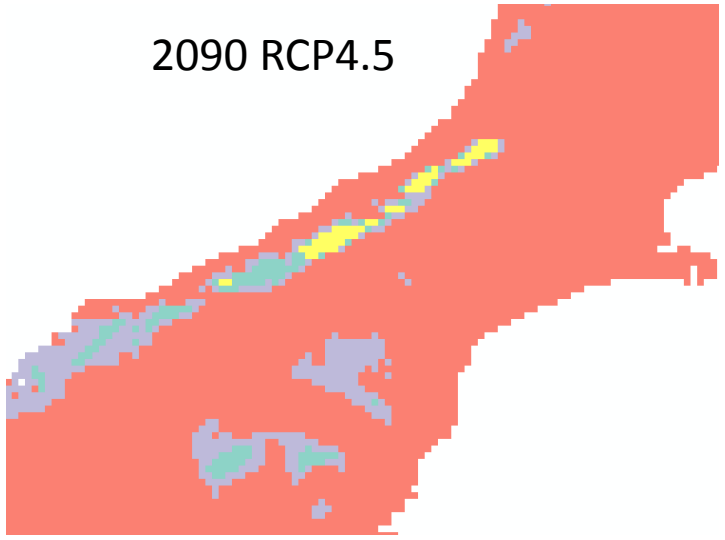


2005

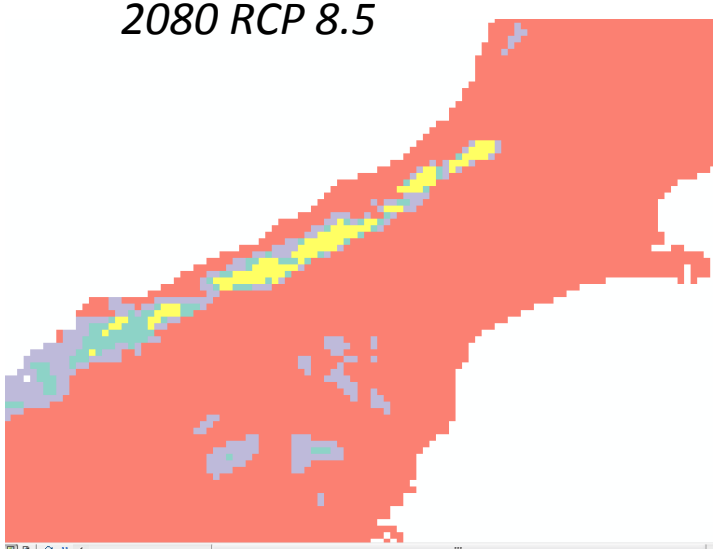
2050 RCP4.5



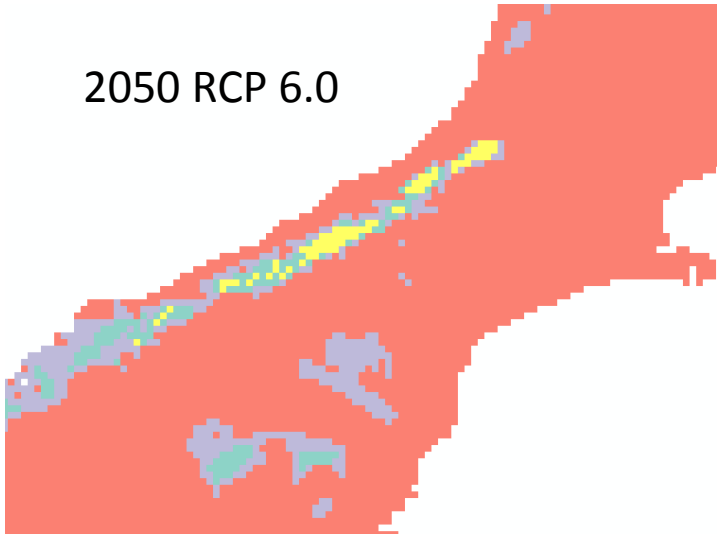
2090 RCP4.5



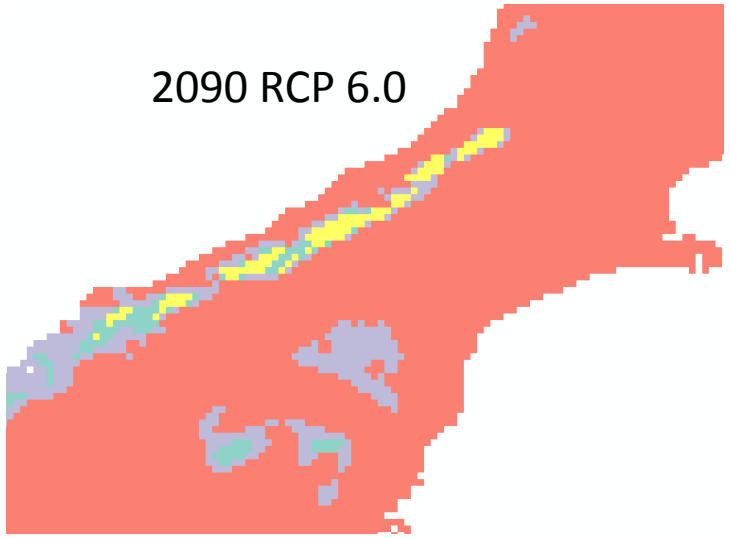
2080 RCP 8.5



2050 RCP 6.0



2090 RCP 6.0



Clematis vitalba – Old Man's Beard

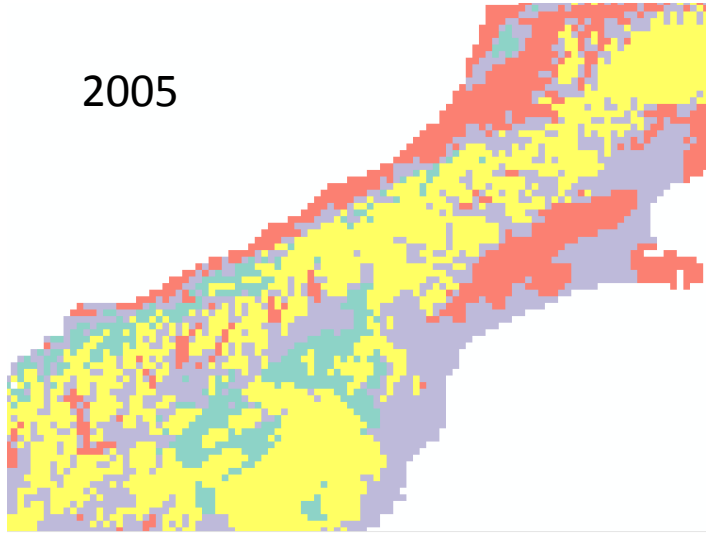
C. vitalba is a very serious environmental weed in New Zealand.

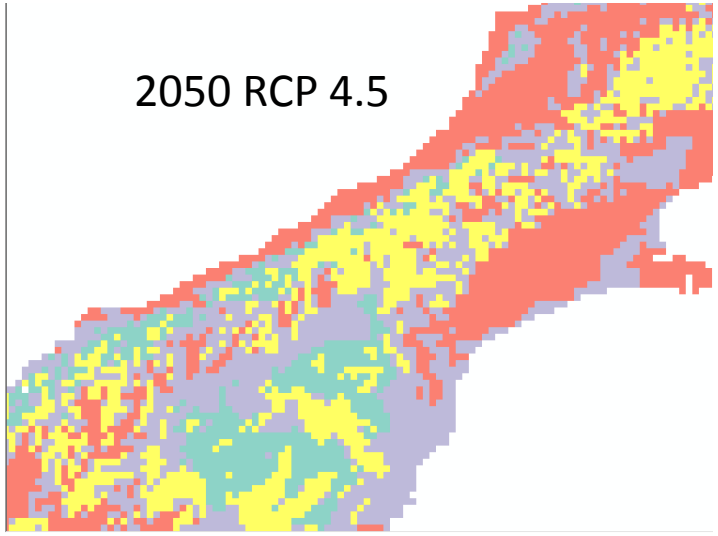
A fast-growing vine with the ability to climb up and bring down tall trees and reduce standing forests to impenetrable low-growing infestations of the vine, suppressing all vegetation beneath, and it is a strong colonizer of disturbed ground.

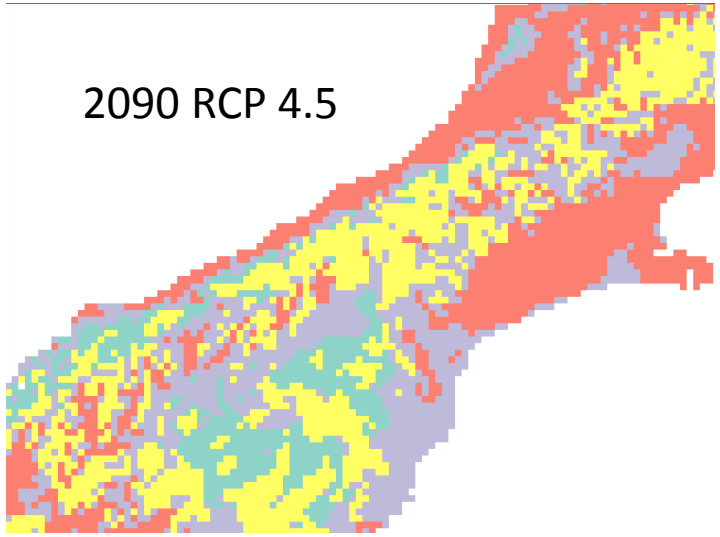
Infestation can reduce the forest structure, and change the recruitment patterns in forests.

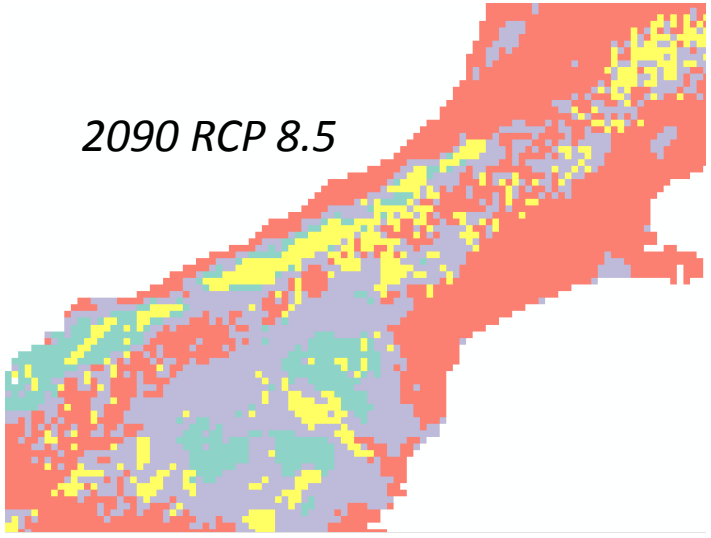
It can reduce small, healthy forest remnants to low, long-lived thickets of vines scrambling over the ground on forest debris.

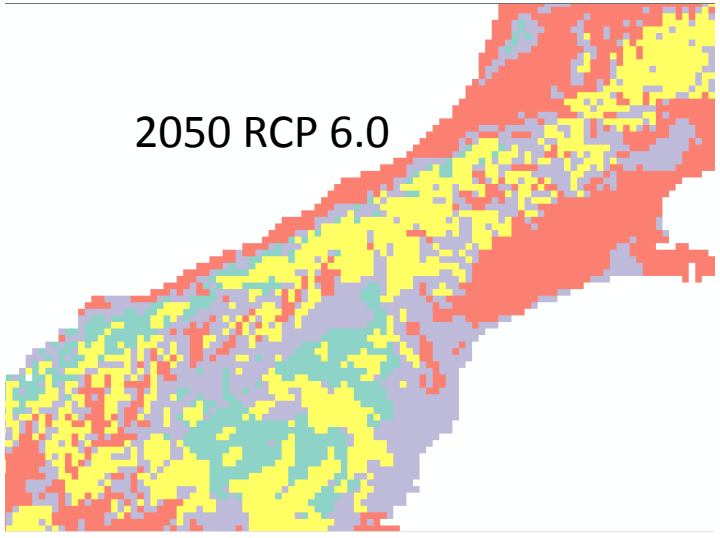
Clematis vitalba – Old Man's Beard

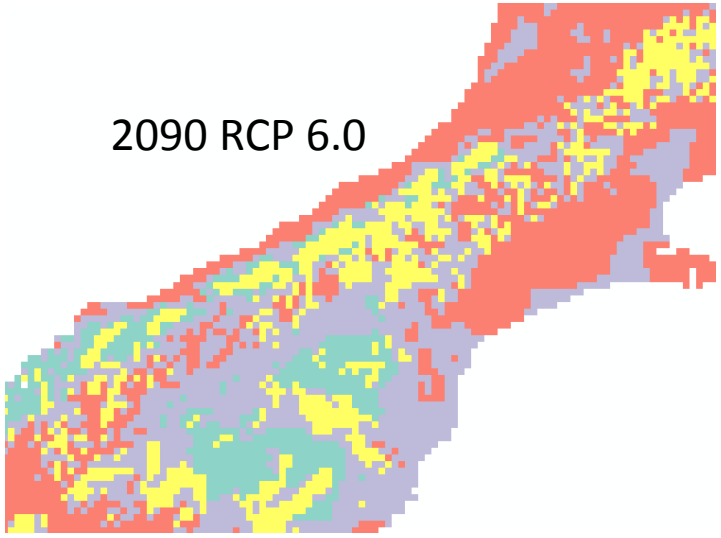












Buddleja Davidii

Buddleja forms dense stands in a wide range of habitats. Buddleia is extremely ecologically versatile, tolerating a wide range of soils, especially poor soils, and frosts,

Thickets establish and grow quickly, and are self-replacing.

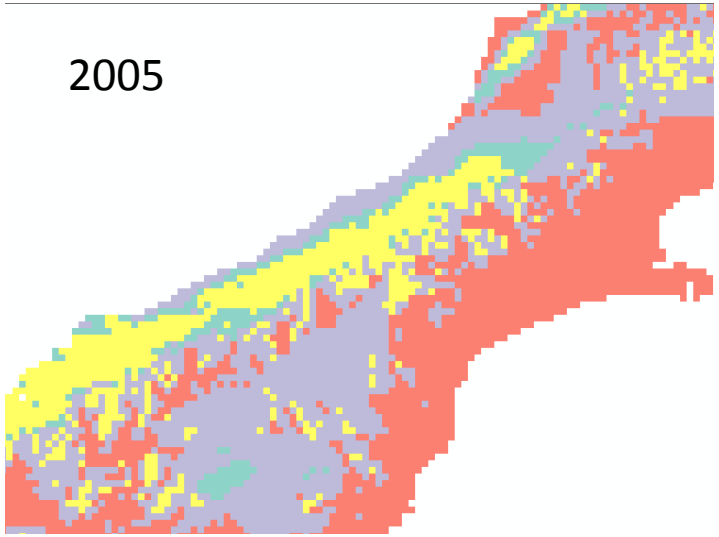
It invades river beds, stream sides, disturbed forest, shrubland margins and bare land, and radiata pine plantations and causes growth reduction and economic losses.

It can modify water flow, enabling silt build up and flooding problems.

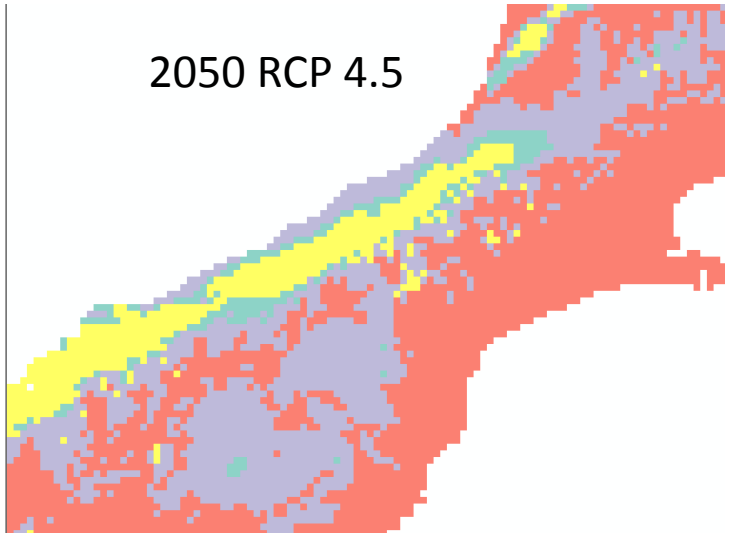
It reseeds into bare ground sites and cut stumps will also resprout.

Buddleja

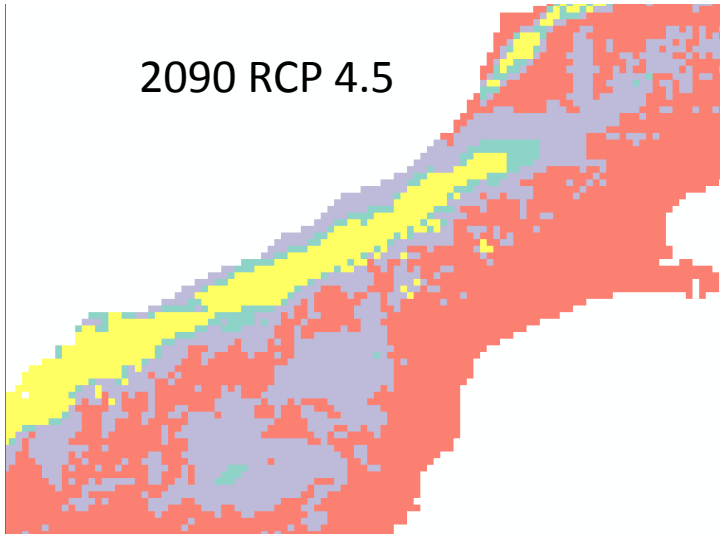
2005



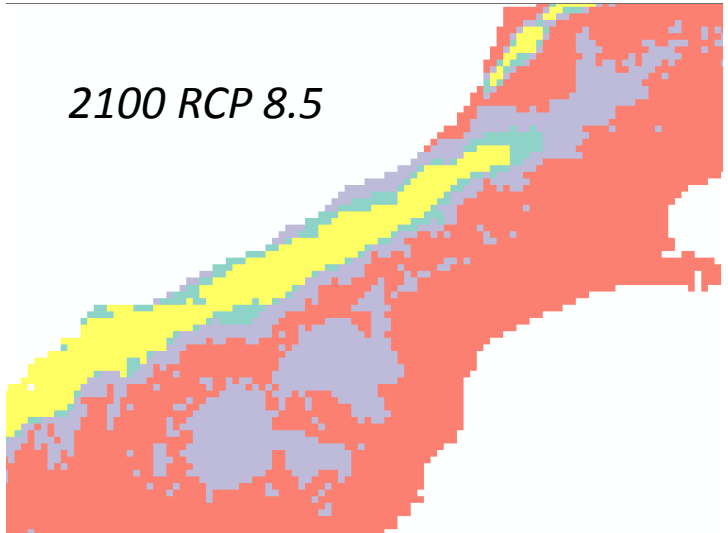
2050 RCP 4.5



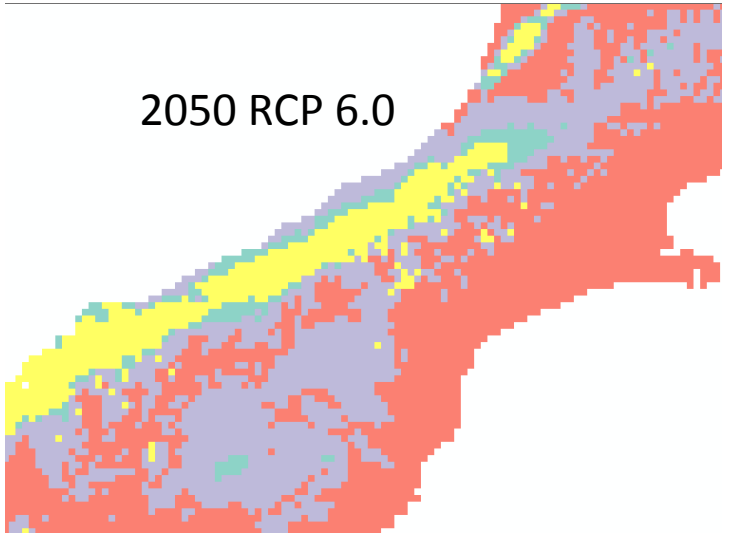
2090 RCP 4.5



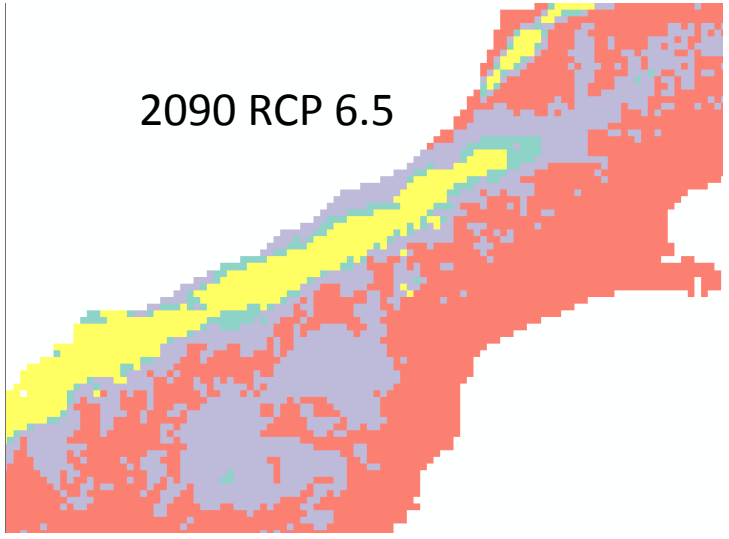
2100 RCP 8.5



2050 RCP 6.0



2090 RCP 6.5



Discussion

- In upland areas, changes are also affected by precipitation as well as temperature and CO2
- In most cases the optimal areas and locations are extending southward and ‘upward’

- How is this data useful? (only presented four species)
- How would you want it?

Contact

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