Landscape Futures
– from aspiration to implementation

Defining options to better manage
our landscape resources now,
and for the future

Life Impact The University of Adelaide

Landscape Futures – what is it and how can it help with regional plans and NRM operations?

- Follow on from Climate Change, Communities and Environment project
- Envisioning develops the story of how people want to experience the process of developing a plan and its implementation in the region
- Landscape Futures Analysis helps provide some content for the regional plan
- What is Landscape Futures Analysis?
  - Concept is that assets in the landscape are inter-dependant
  - We identify 5 steps from base information about the region through to costed management options that can help the region adapt
- Can you identify how the information may be helpful?
- Who needs to be involved?
- Are the “indicators of progress” being realised?

Step 1. Base datasets

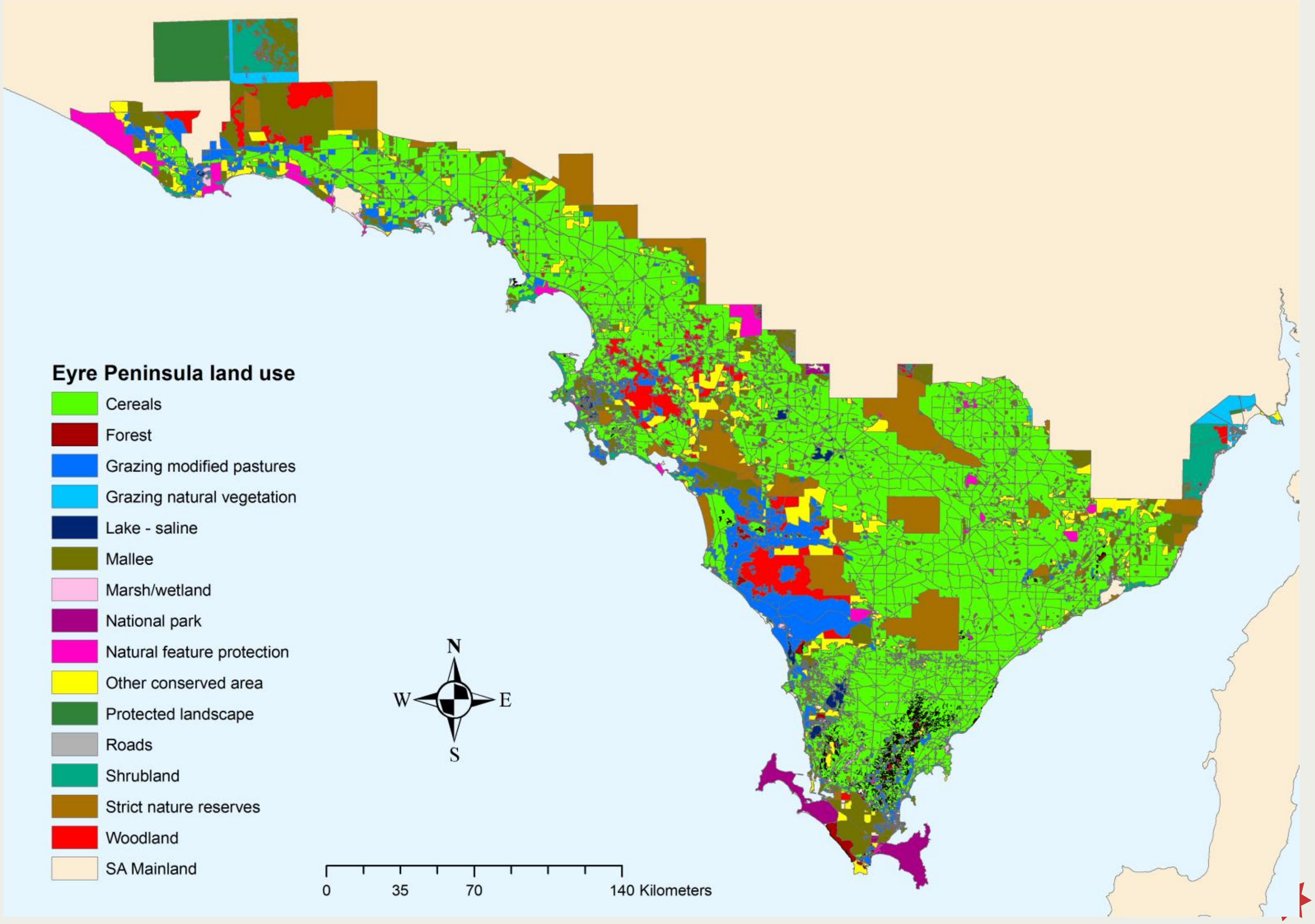
Assemble spatial datasets to represent the location of where things are.

These include locations of **assets** such as roads, towns, native vegetation mostly held by DEWNR

Measurements at specific locations on climate, soils, biodiversity

Measurements mapped across the region such as rainfall, soils, topography demographics, remotely sensed measures of vegetation growth and soil exposure

What is available is highlighted in Eyre Peninsula datasets report



e.g. Spatial distribution of land uses, roads, towns etc.

Step 1. Base datasets

Do you think this information is useful in NRM planning/decision making?

Have you used these previously?

How, when and where would you consider using this information set?

Maybe...
Current and past NRM projects - spatial extent of on ground works and asset management

Step 2 - 1st stage derivation of base datasets

Refine base dataset to make them application and regionally specific

Conceptually try to use base datasets to:

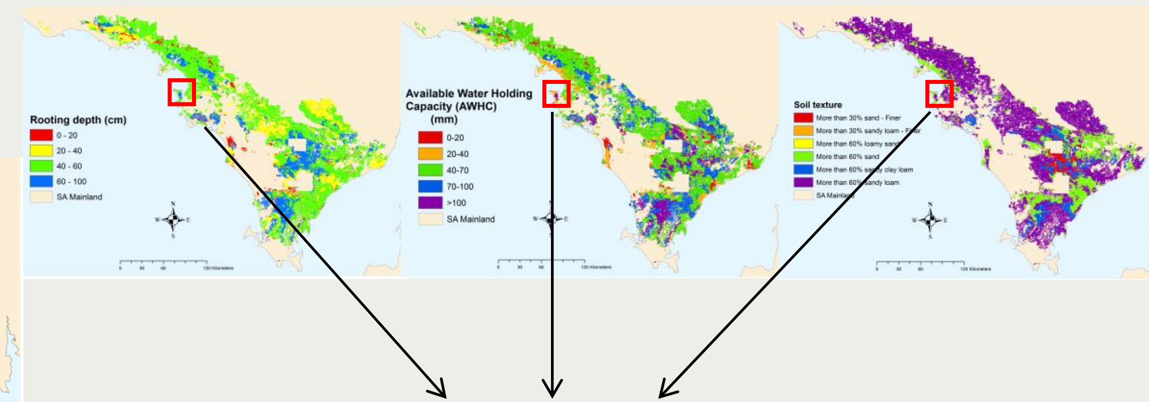
1. distinguish and quantify geographic patterns
2. act as spatial surrogates of landscape attributes
3. configuration and composition of current assets used to highlight potential areas where action may or may not take place

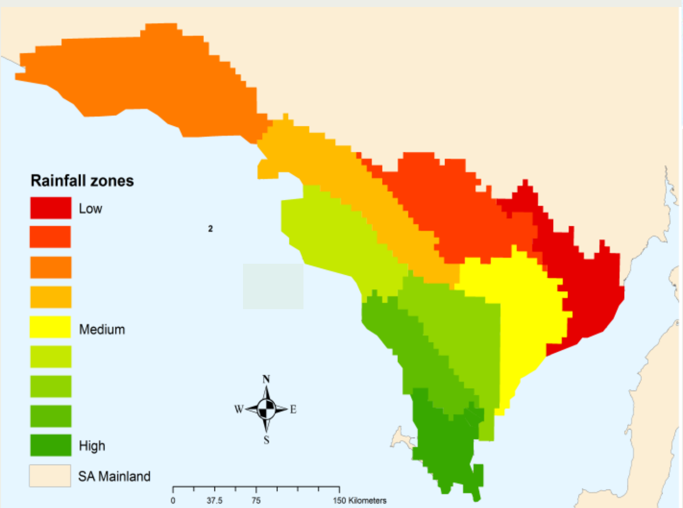
Step 2 - 1st stage derivation of base datasets

1. Distinguish and identify geographic patterns

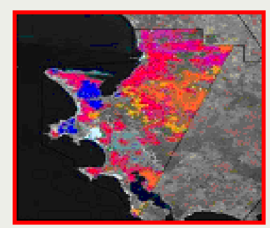
Statistical clustering of rainfall datasets to distinguish areas of similar rainfall

Mapped soils reinterpreted and classified to map 'bucket size' to be used in crop simulation modelling





Bucket size



high resolution buckets sizes of a broad extent

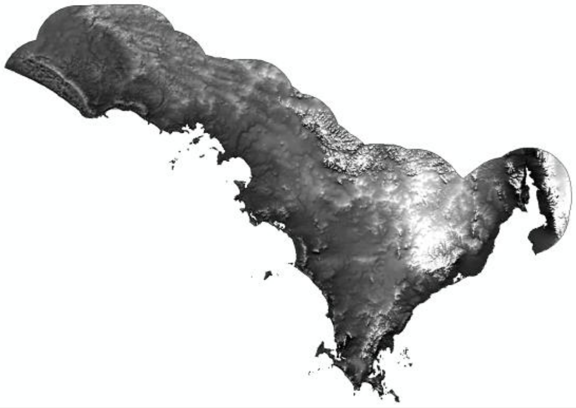
Step 2 - 1st stage derivation of base datasets

2. Act as spatial surrogates for landscape attributes (e.g. soil clay or soil pH)

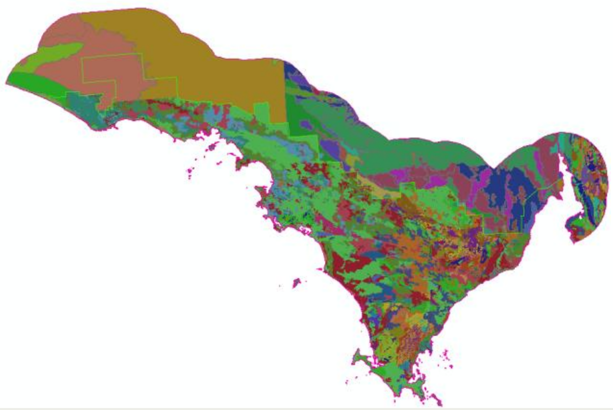
Interpretation of spatial information (topography, soils, climate) to act as predictive surrogates for species distribution

Mapping of potential areas for native vegetation corridors based on the geographic pattern of current native vegetation

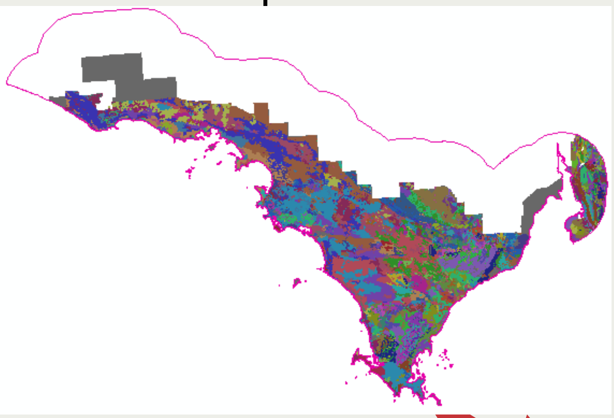
Solar radiation



Clay



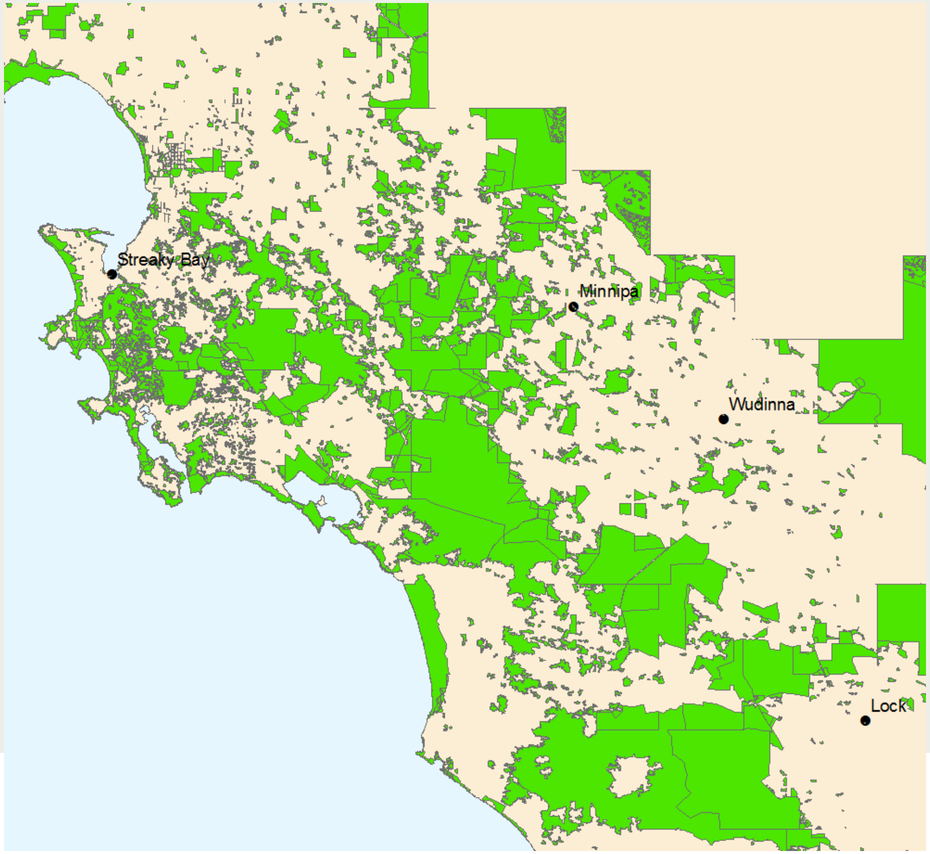
pH



Step 2 - 1st stage derivation of base datasets

3. Configuration and composition of current assets used to highlight potential areas where action may or may not take place

Highlight potential areas for native vegetation based on the current geographic pattern and possible geographic compositions in the future



More area, less fragmentation or increased connectivity through the landscape
(landscape ecology metrics)

Exclusion zone of where not to put trees

Do you think this information is useful in NRM planning/decision making?

Have you used these previously?

How, when and where would you consider using this information set?

Step 3 - Modelling spatial distributions

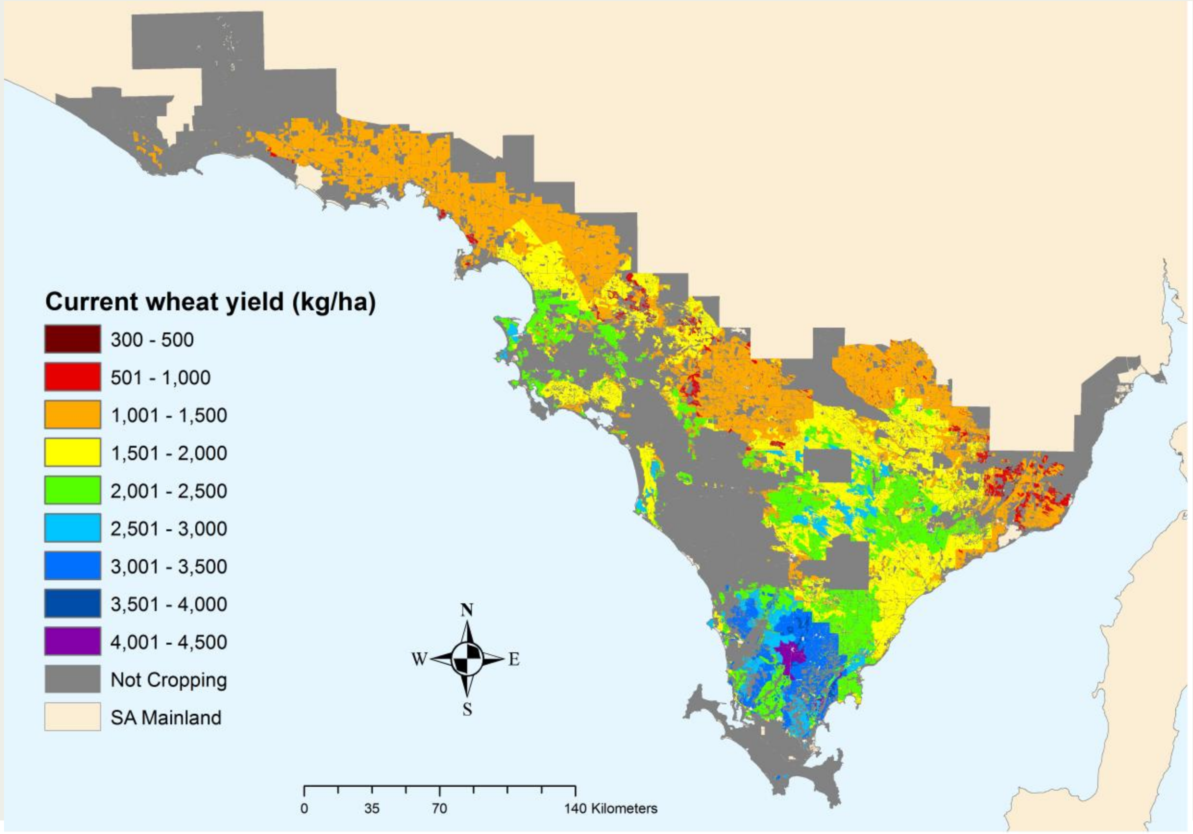
Used data from Steps 1 and 2 to project and extrapolate over space and time

- Create models
    - Production – e.g. cropping, forest growth etc
    - Biodiversity – e.g. species distribution modelling
- Models require **assumptions and generalisations**
    - Simplification of the real world
- Calibration and validation is important
    - iterative process – refine and reconsider

Check to see if modelling and assumptions used create reliable estimates of the real world with local data or expert knowledge

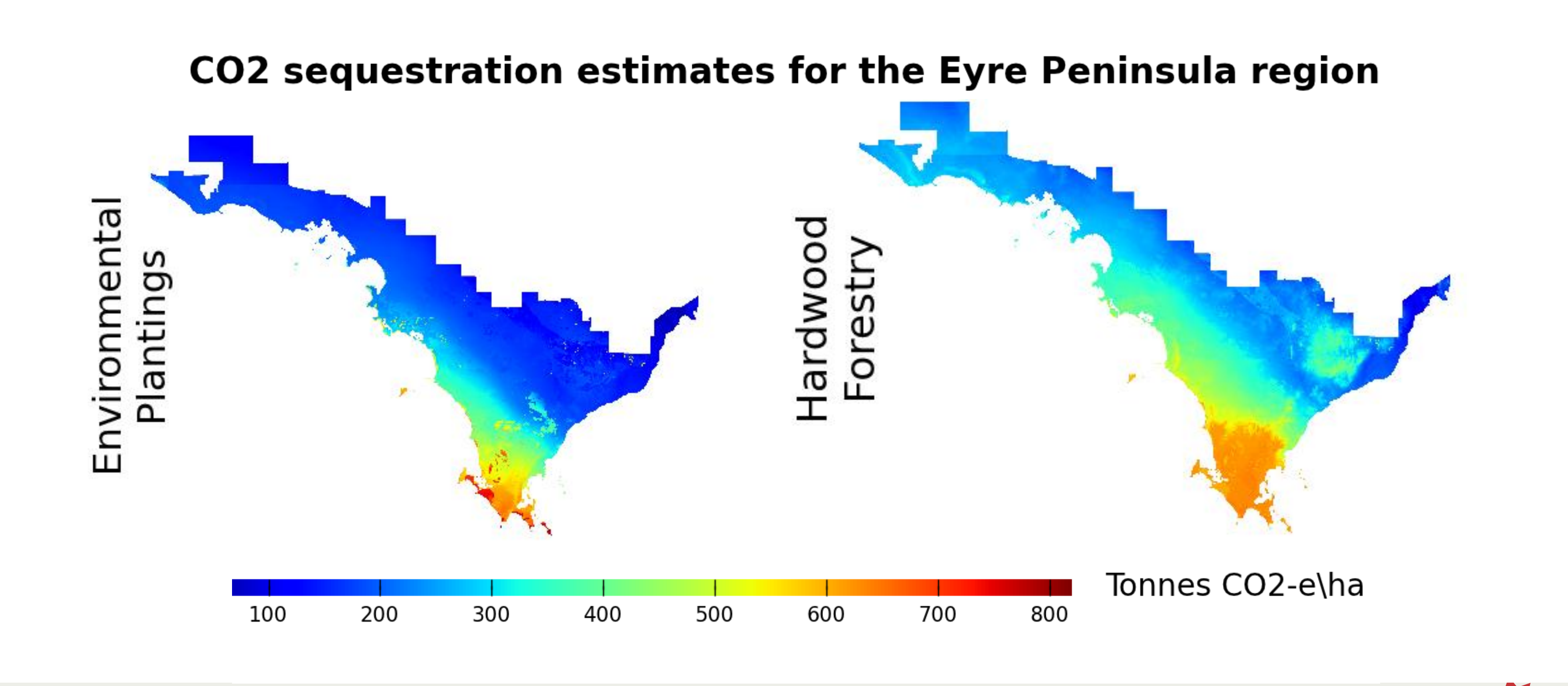
Step 3 - Modelling spatial distributions

Productivity- point based crop simulation model (ASPIM) used to estimate wheat yields throughout the region. Yields vary depending on local climate and local soils. The influence of soils is through the "bucket size" – how much water it can hold.



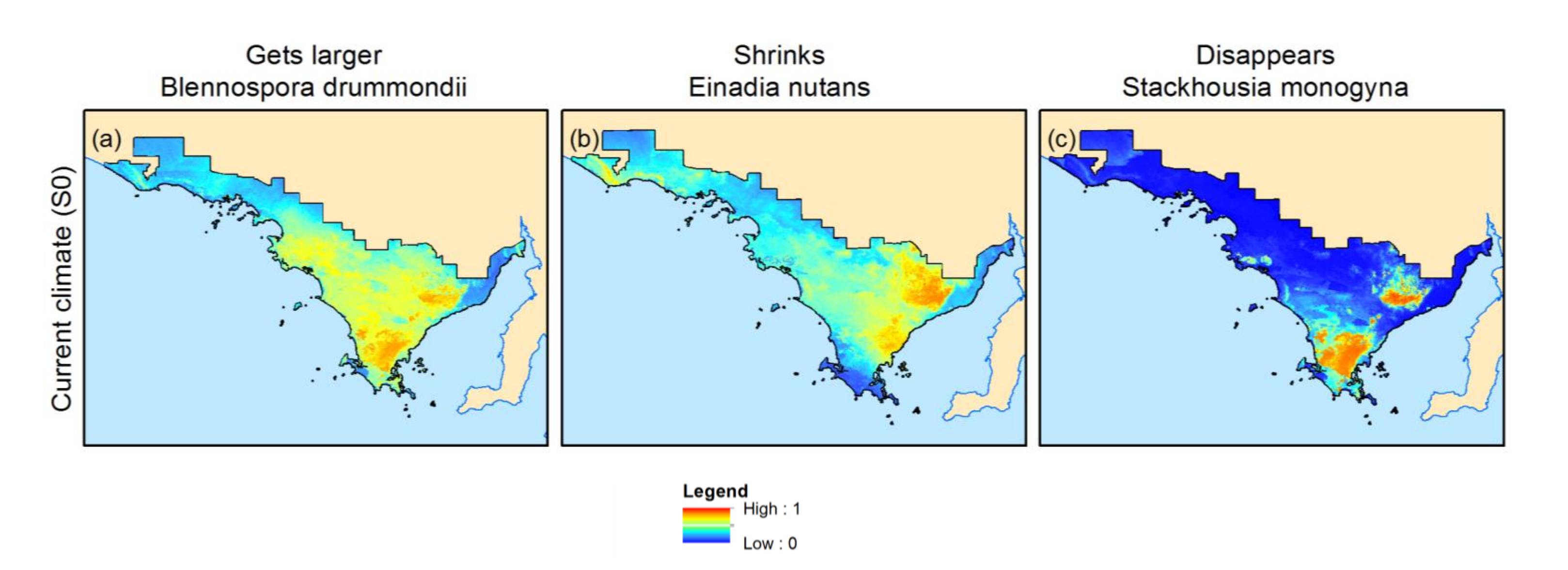
Step 3 - Modelling spatial distributions

Estimates of carbon accumulation are modelled with a tree growth (3PGS2) model that uses inputs of local climate, soils and tree growth characteristics

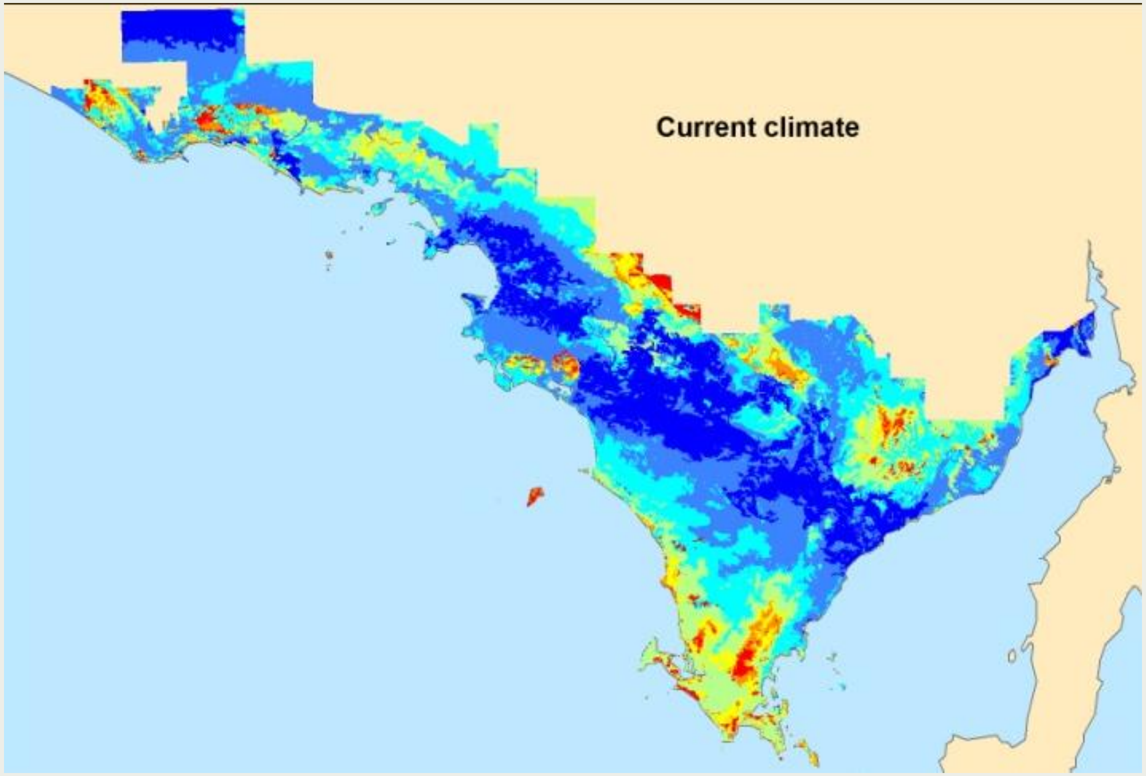


Step 3 - Modelling spatial distributions

Biodiversity distribution – spatial distribution of species and spatial surrogates used to determine current distribution.



Biodiversity priorities



Step 3 - Modelling spatial distributions

We can incorporate satellite derived estimates of soil erosion risk (From Ken Clarke and Megan Lewis at UA)

How exposed a soil is and how long it remains exposed determines the soil erosion risk

A satellite image (soil exposure index) allows us to determine exposure on a single date

Imagery is available every 16 days from 2000 to present

Gives a measure of soil erosion risk across space and time

Number of days vulnerable to erosion per year (<50% soil cover) shows which areas are more vulnerable to erosion

Highlight areas that are more or less exposed than the regional average

...movie...

Do you think this information is useful in NRM planning/decision making?

Have you used these previously?

How, when and where would you consider using this information set?

Step 4 – Including the effects of climate change

Use the models to estimate responses to possible futures with climate change?

What is a scenario?

Steps 1 and 2 datasets are manipulated to reflect climate change scenarios based on estimates from Intergovernmental Panel on Climate Change (IPCC), Australian Bureau of Meteorology and CSIRO.

Current: 390ppm CO_2
Short term – 10 years: +1 degree, -5% rainfall, 480ppm CO_2
Medium term – 2030: +2 degree, -15% rainfall, 550ppm CO_2
Long term - 2070: +4 degree, -25% rainfall, 750ppm CO_2

Projections are based on conservative estimates of what climate in the region might be like in the future

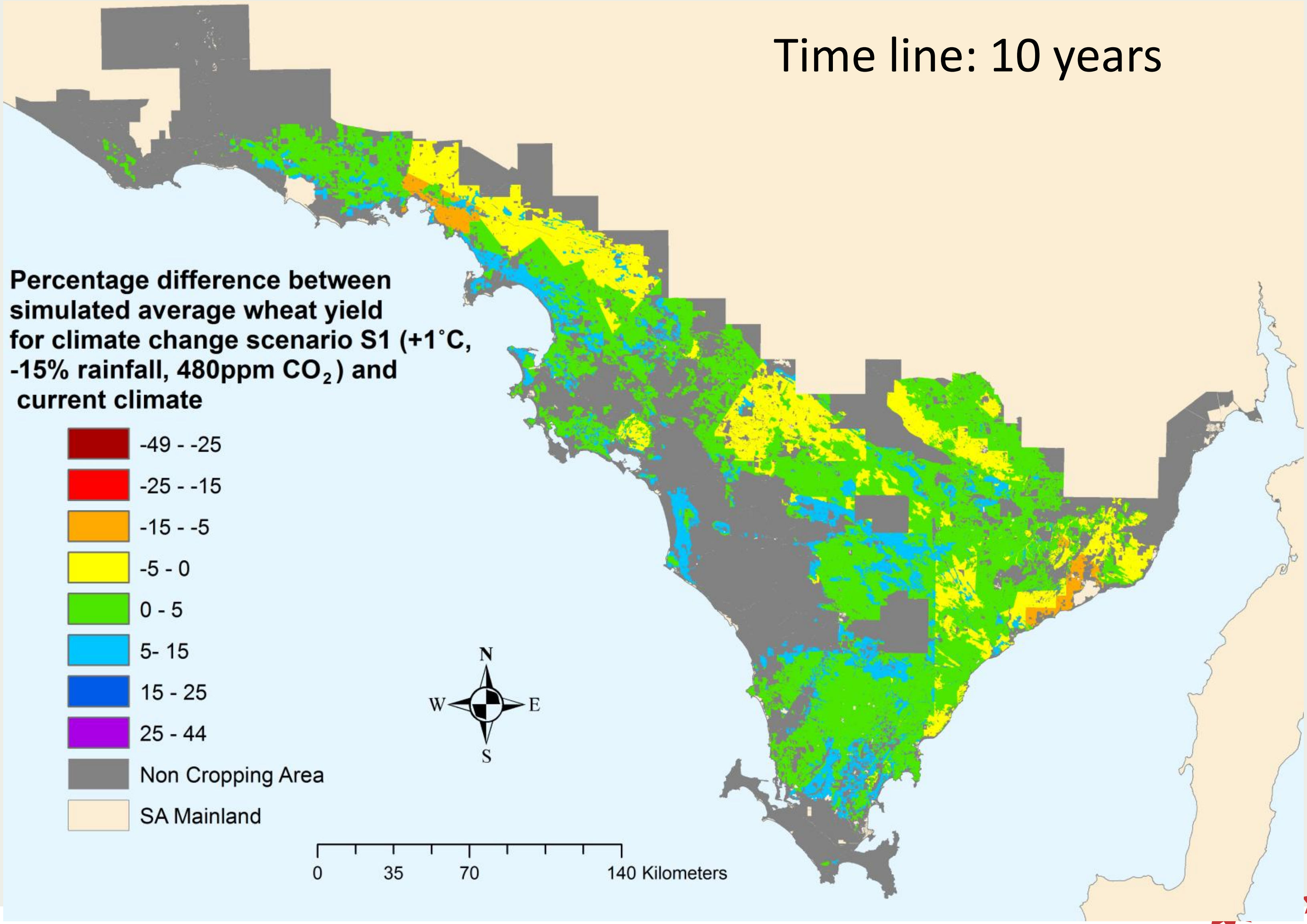
Step 4 – Implications of climate change scenarios

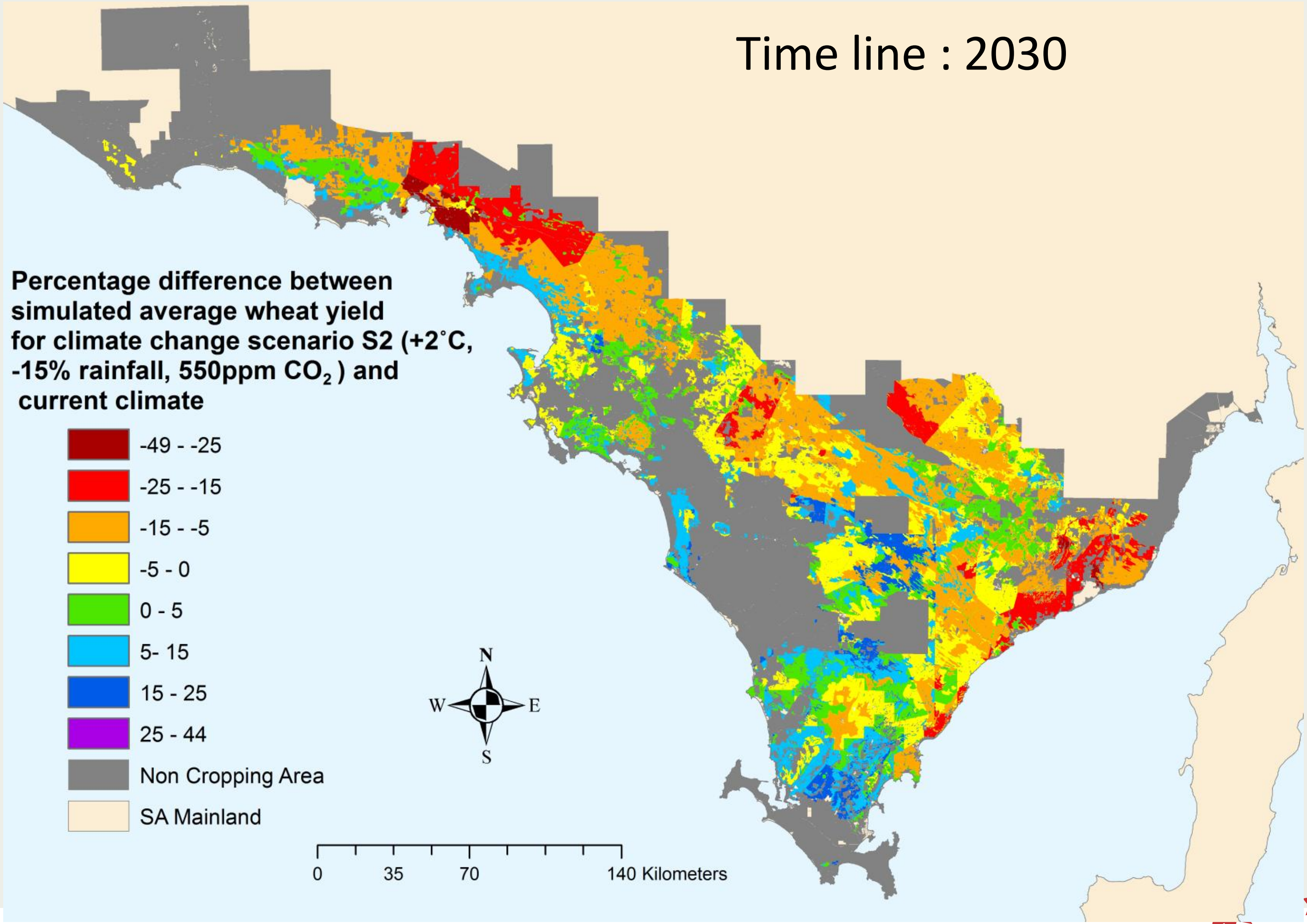
Understand the spatial implications of climate change on regional assets

Change in current productivity, biodiversity distribution, carbon accumulation from increased temperature and CO_2 and reduction in rainfall (can have multiple futures)

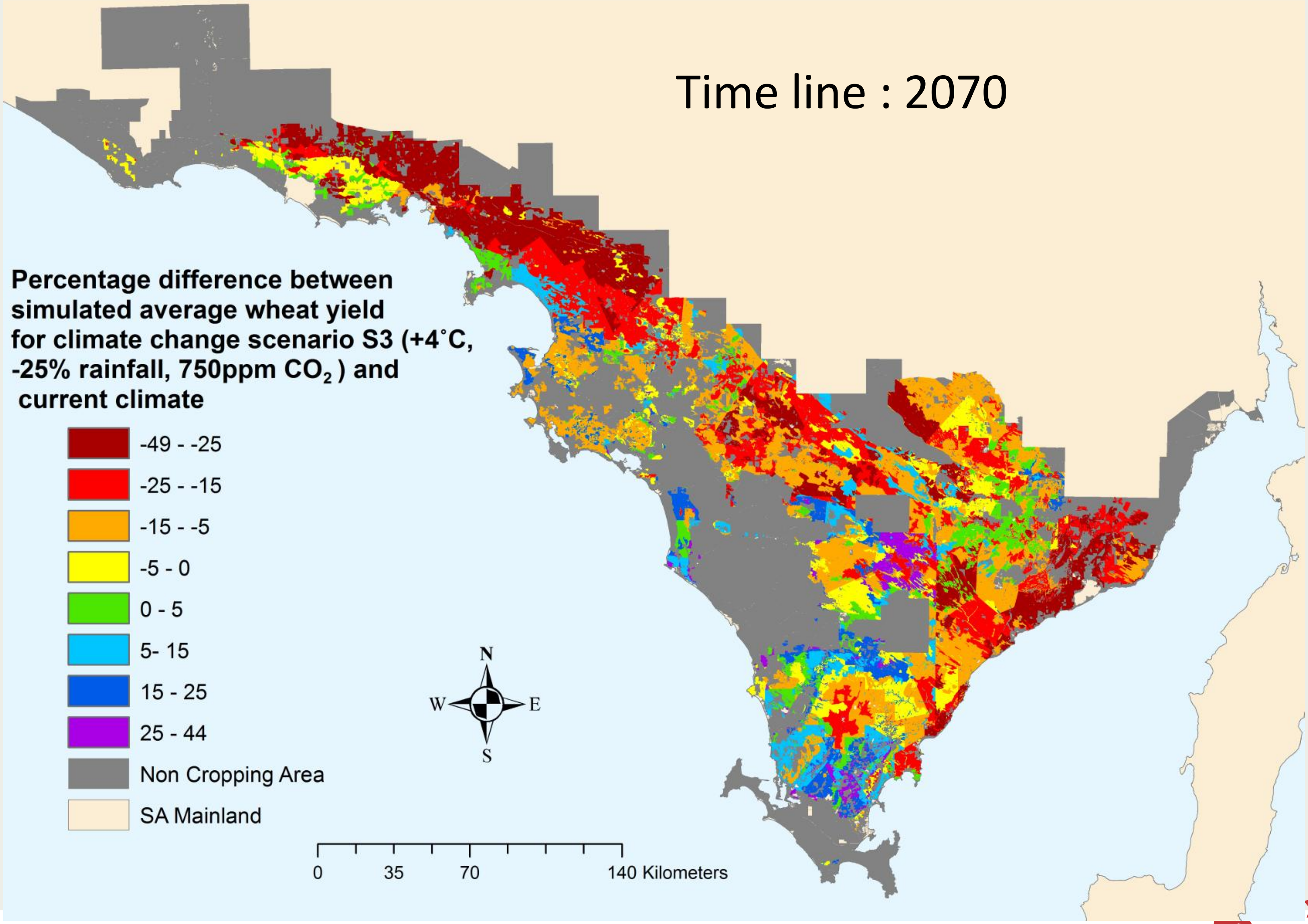
Understand the interaction of global prices on inputs and outputs from current land uses under a variable climate change (can have multiple futures and prices levels)

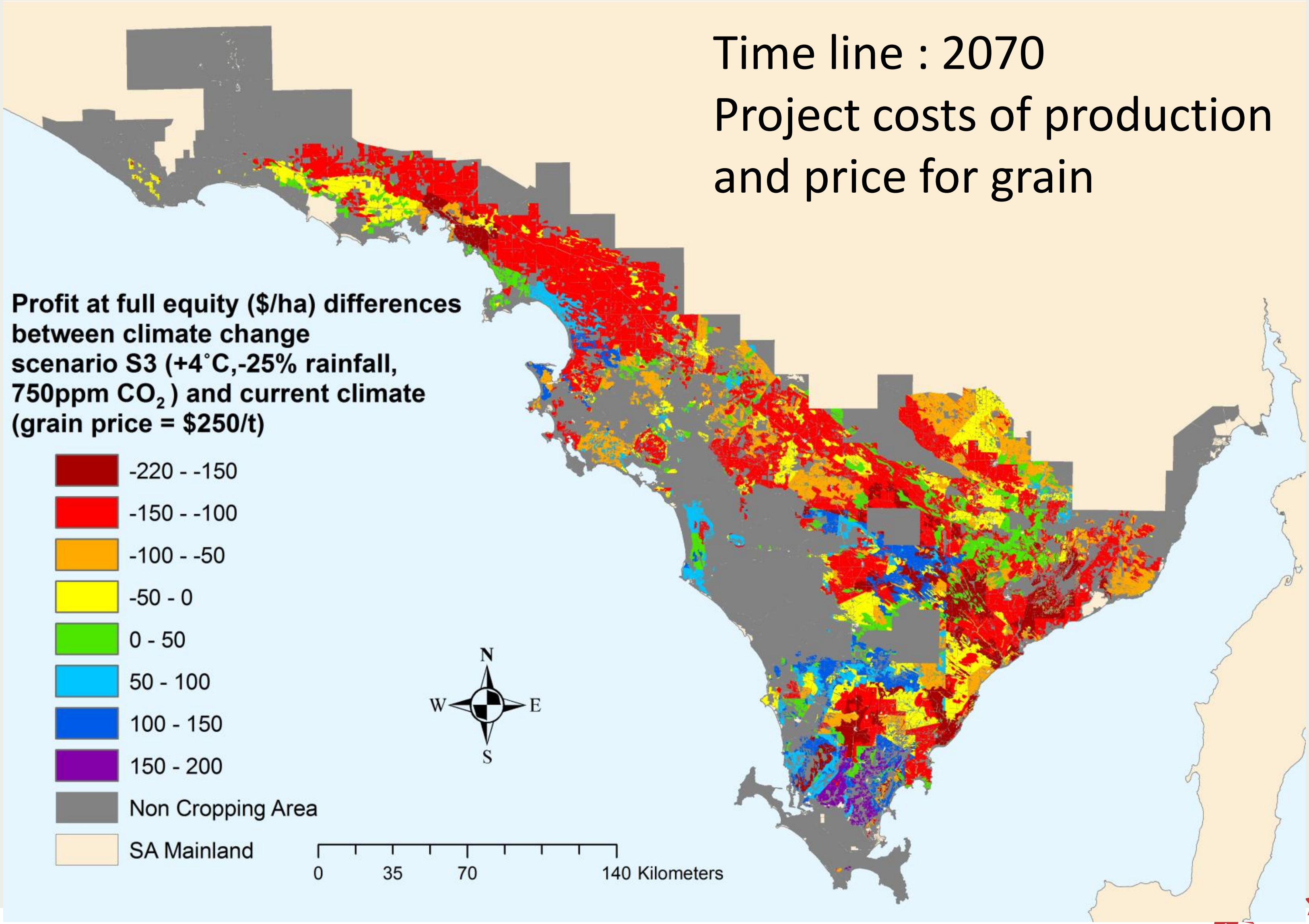
Understand the potential adoptability of new land uses based on new price interactions under a variable climate change (can have multiple futures, options and prices levels)


Time line: 10 years
Percentage difference between simulated average wheat yield for climate change scenario S1 (+1˚C, -15% rainfall, 480ppm CO_2) and current climate
-49 - -25
-25 - -15
-15 - -5
-5 - 0
0 - 5
5- 15
15 - 25
25 - 44
Non Cropping Area
SA Mainland
N
W
E
S
0
35
70
140 Kilometers

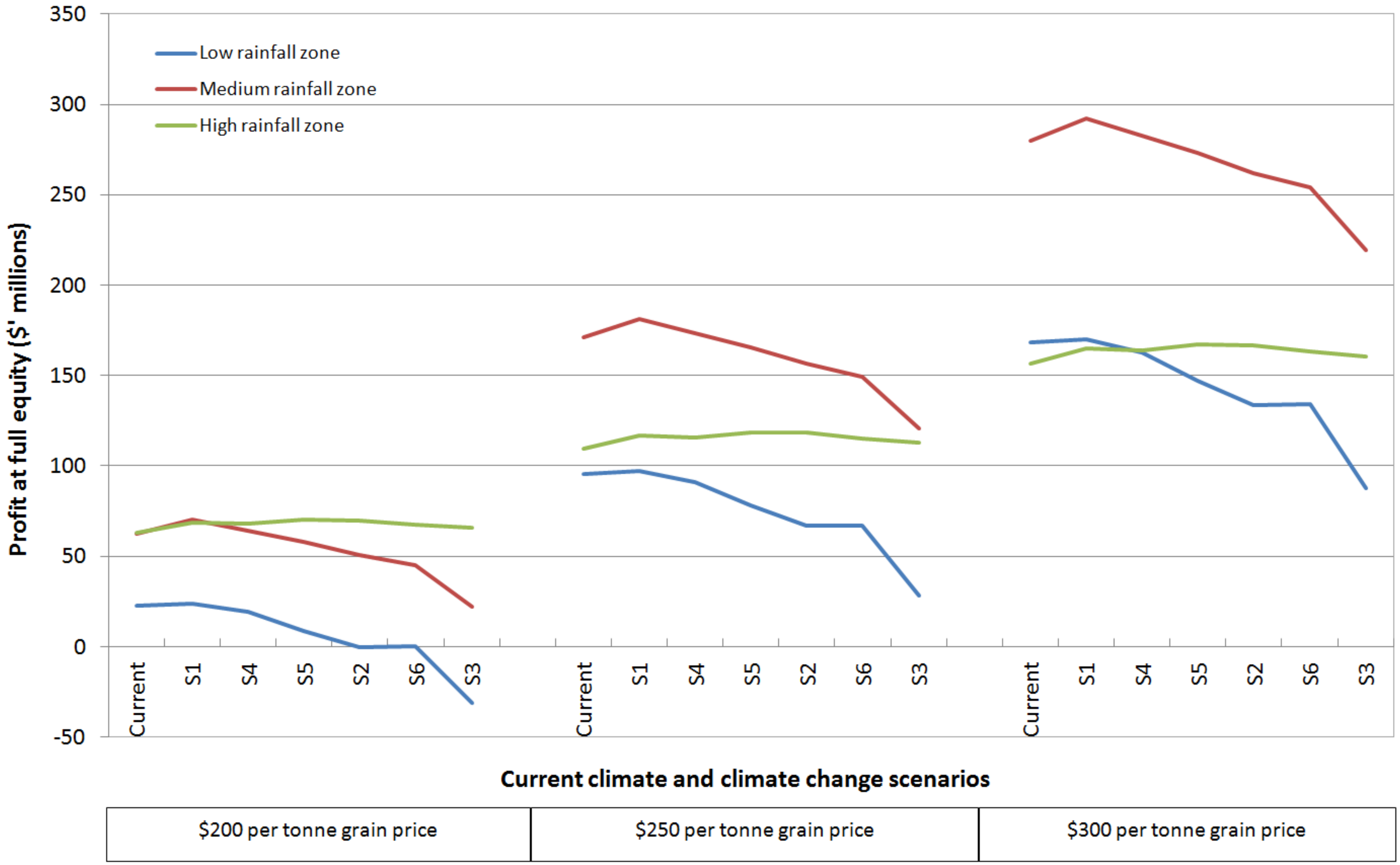


Time line : 2030
Percentage difference between simulated average wheat yield for climate change scenario S2 (+2˚C, -15% rainfall, 550ppm CO_2) and current climate
-49 - -25
-25 - -15
-15 - -5
-5 - 0
0 - 5
5- 15
15 - 25
25 - 44
Non Cropping Area
SA Mainland
N
W
E
S
0
35
70
140 Kilometers

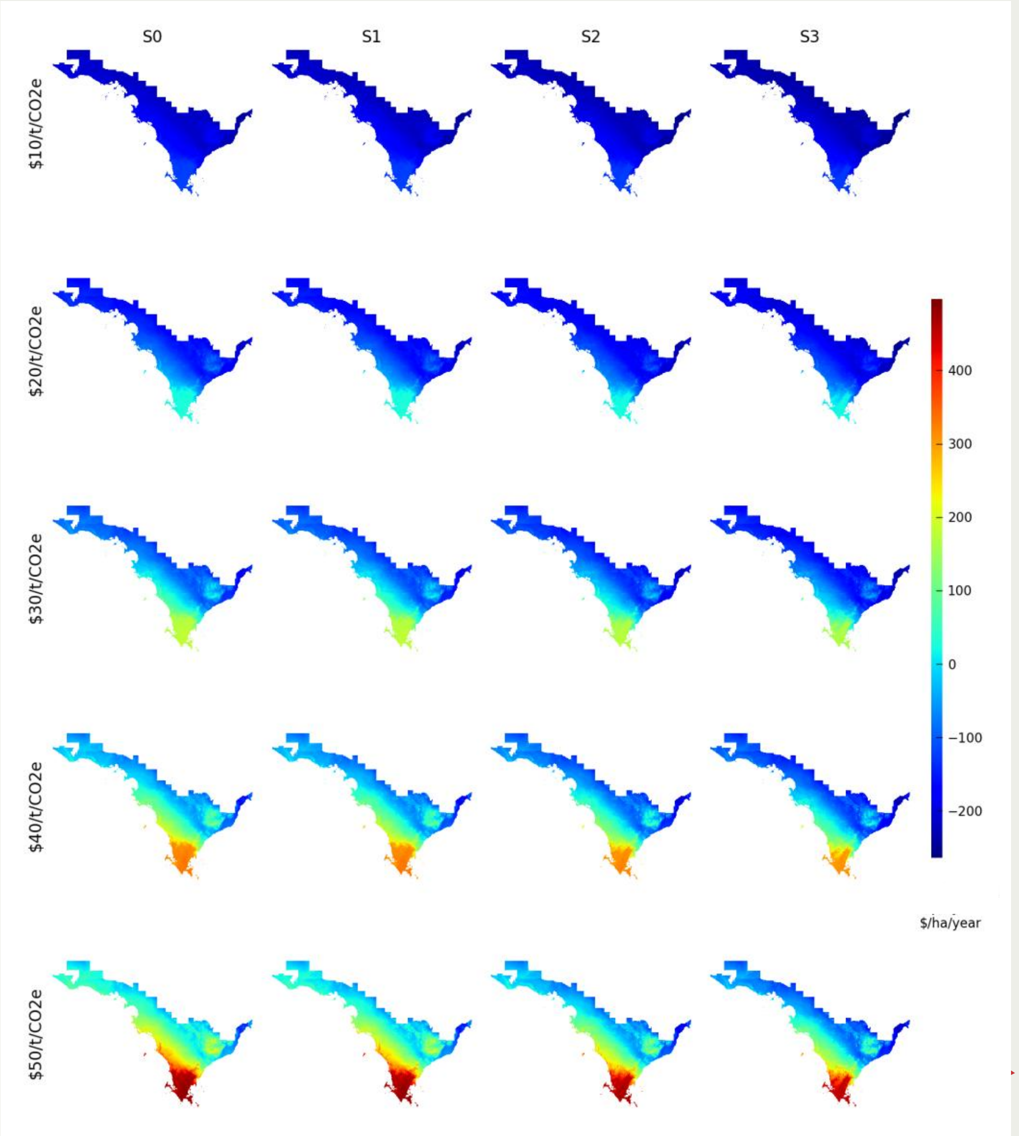

Time line : 2070
Percentage difference between simulated average wheat yield for climate change scenario S3 (+4˚C, -25% rainfall, 750ppm CO_2) and current climate
-49 - -25
-25 - -15
-15 - -5
-5 - 0
0 - 5
5- 15
15 - 25
25 - 44
Non Cropping Area
SA Mainland
N
W
E
S
0
35
70
140 Kilometers


Time line : 2070
Project costs of production
and price for grain
Profit at full equity ($/ha) differences between climate change scenario S3 (+4˚C,-25% rainfall, 750ppm CO_2) and current climate (grain price = $250/t)
-220 - -150
-150 - -100
-100 - -50
-50 - 0
0 - 50
50 - 100
100 - 150
150 - 200
Non Cropping Area
SA Mainland
N
W
E
S
0
35
70
140 Kilometers

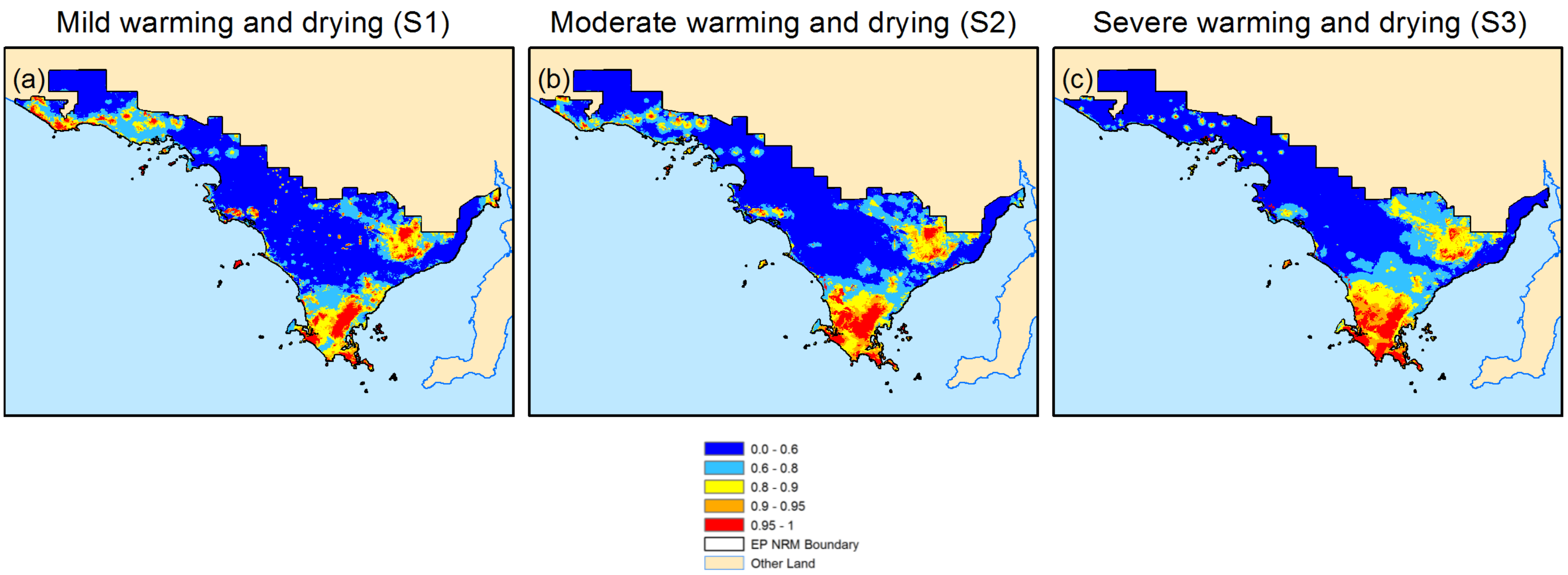
Not just pretty informative maps- numbers behind for EP regional analysis



Regional distribution of $'s generated by growing biomass at different prices for carbon



Biodiversity priority projections



Do you think this information is useful in NRM planning/decision making?

Have you used these previously?

How, when and where would you consider using this information set?

Step 5 - Integration

Step 4 outputs can inform us on the possible arrangement, value and distribution of regional assets under multiple futures, options and prices

Optimisation process identifies “best for” ...carbon, economics, environment, or mixture of all [many options are possible]

Interactive approach to set targets – aspirational or imperative

Interactive approach to allocate investment dollars

Quantify the potential trade-offs involved looking for win-win scenarios

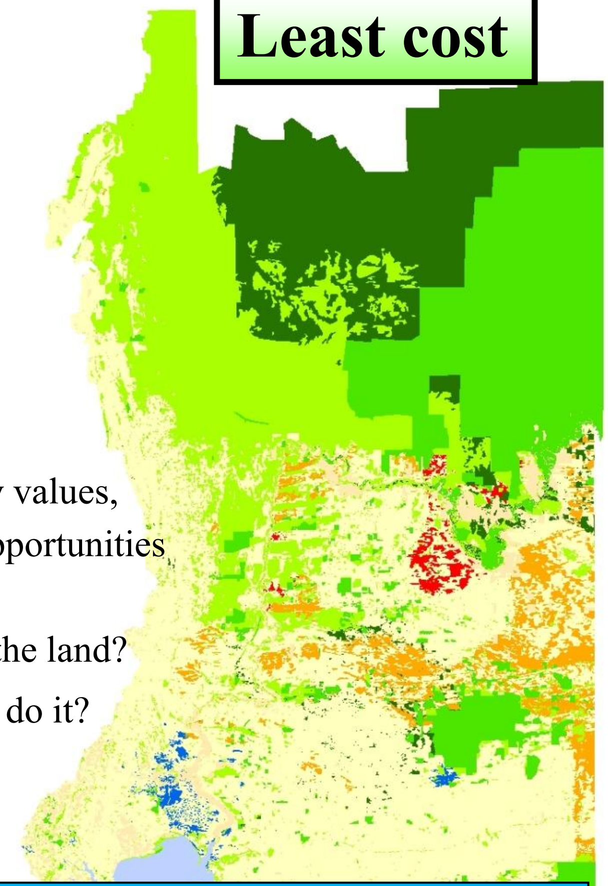
Identify options available

Multiple indicators

Multiple land uses

Example output from optimisation based on economics

Least cost



- Changes in:
  - climate,
  - markets,
  - community values,
  - changed opportunities
- How we use the land?
- Where do we do it?

Cost:
-1.2% of agricultural GRP

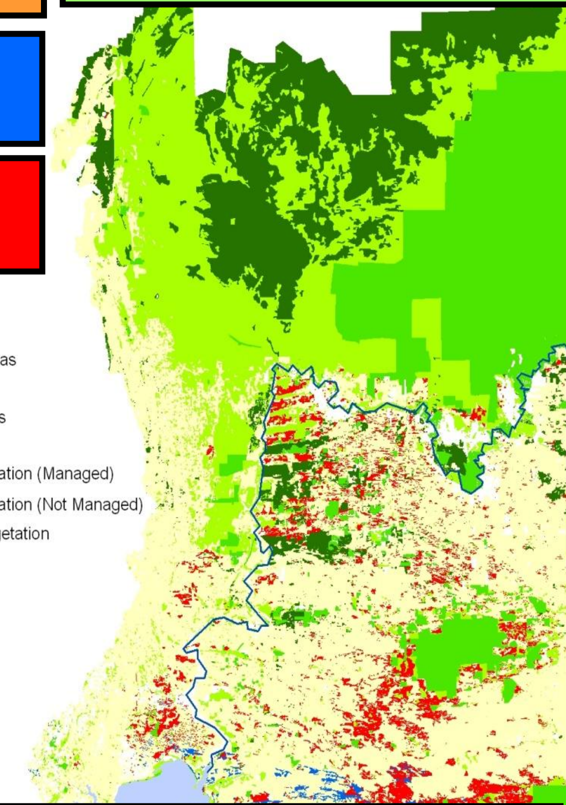
Conservation farming

Deep rooted perennials

Ecological restoration

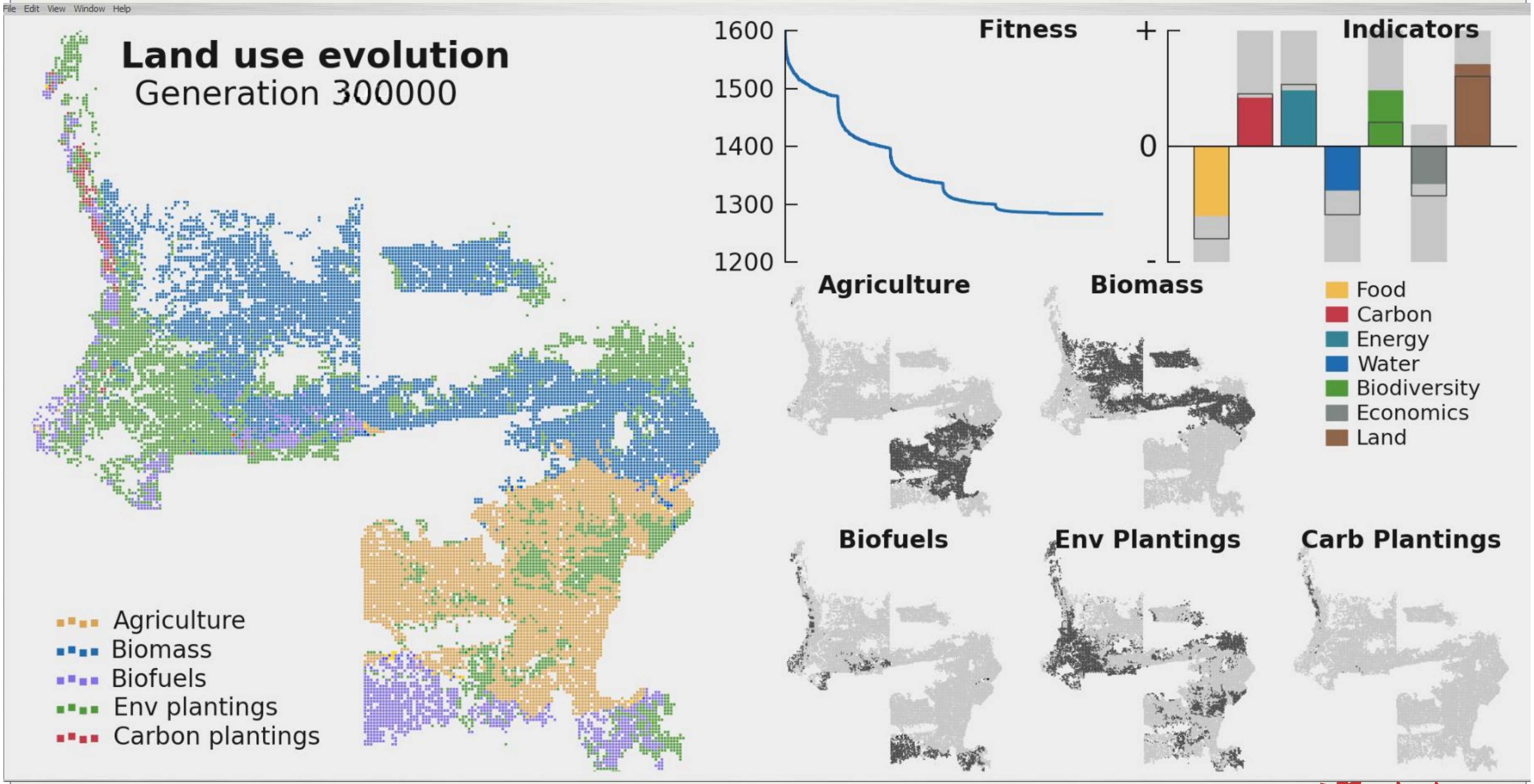
- Cleared Agricultural Areas
- Conservation Farming
- Deep Rooted Perennials
- Ecological Restoration
- Private Remnant Vegetation (Managed)
- Private Remnant Vegetation (Not Managed)
- Protected Remnant Vegetation

Most cost effective



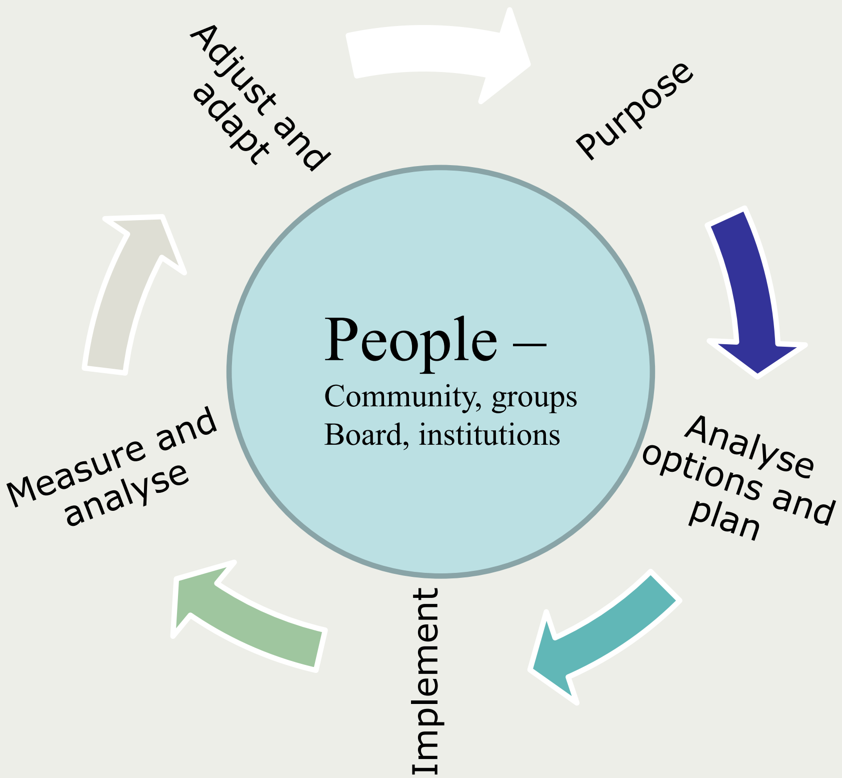
Cost:
-12.1% of agricultural GRP

Example of possible land use that would evolve to achieve the best balance between 7 equally weighted indicators

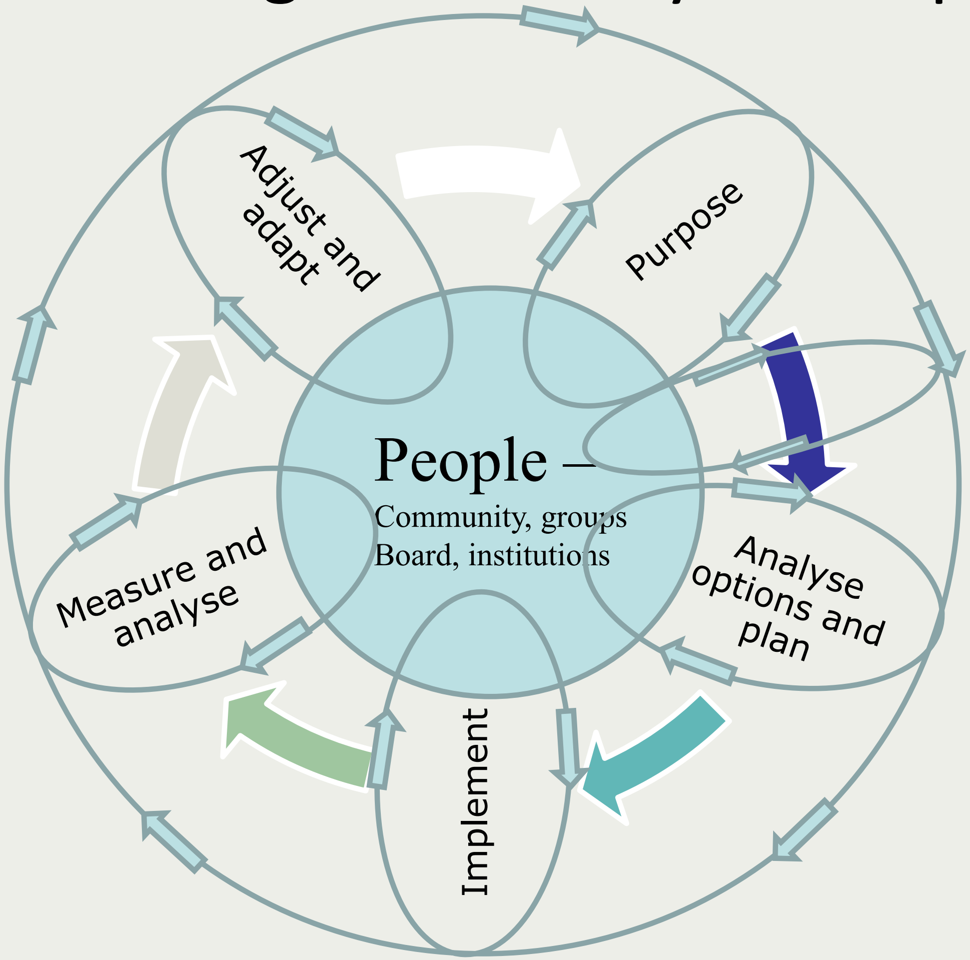


Our focus – helping people adapt

The management cycle

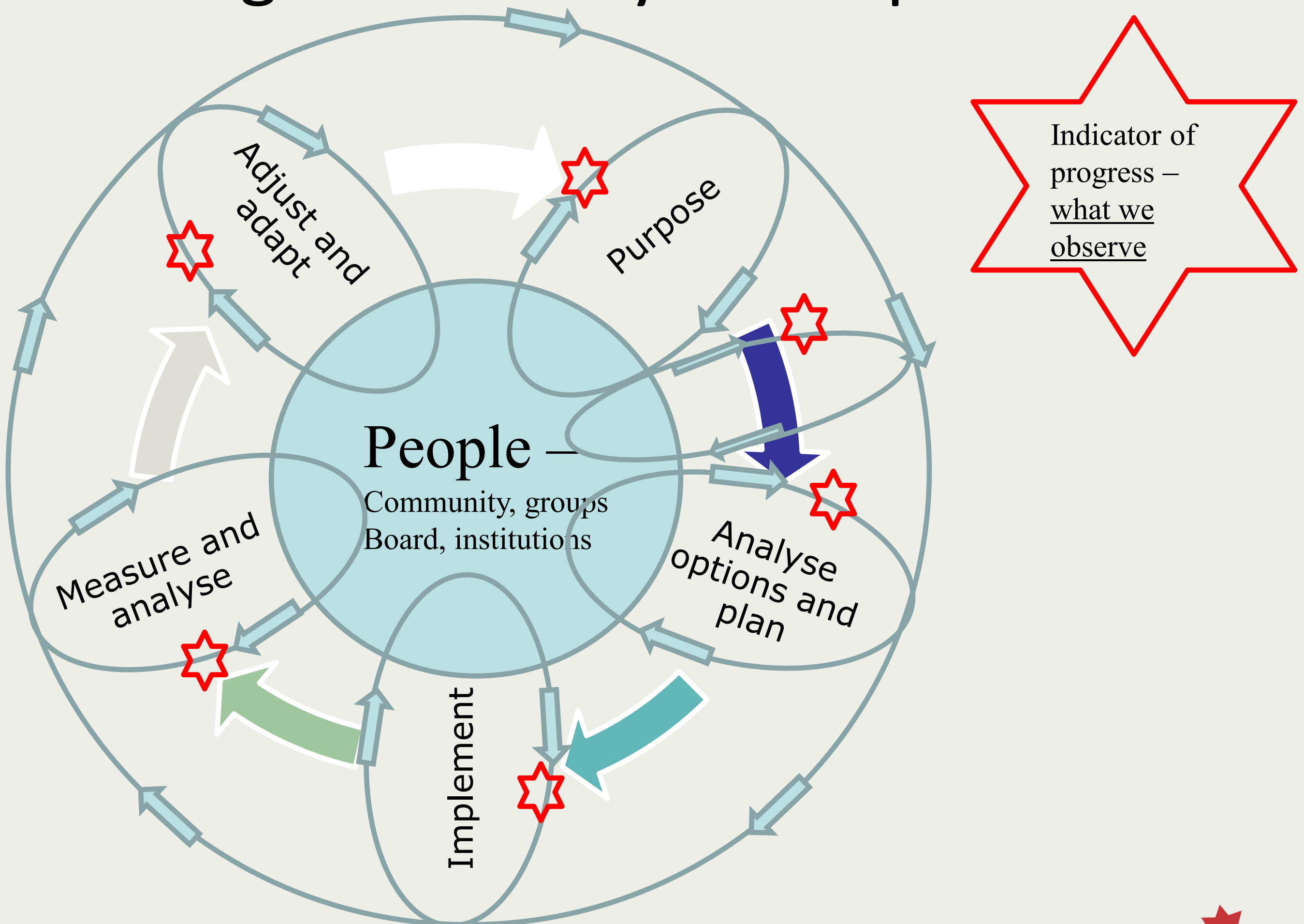


Embedding community in the process



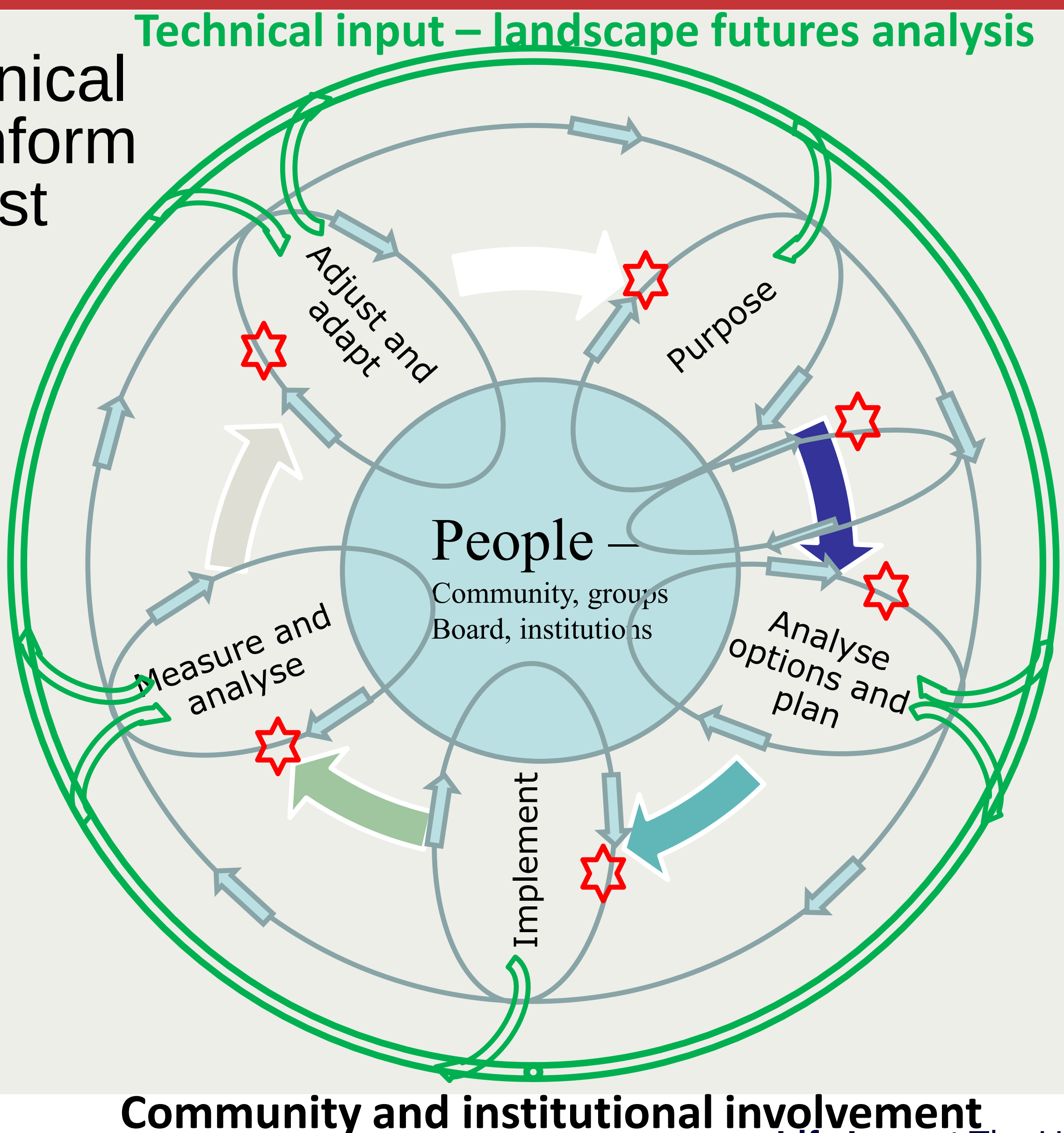
Community and institutional involvement

Embedding community in the process

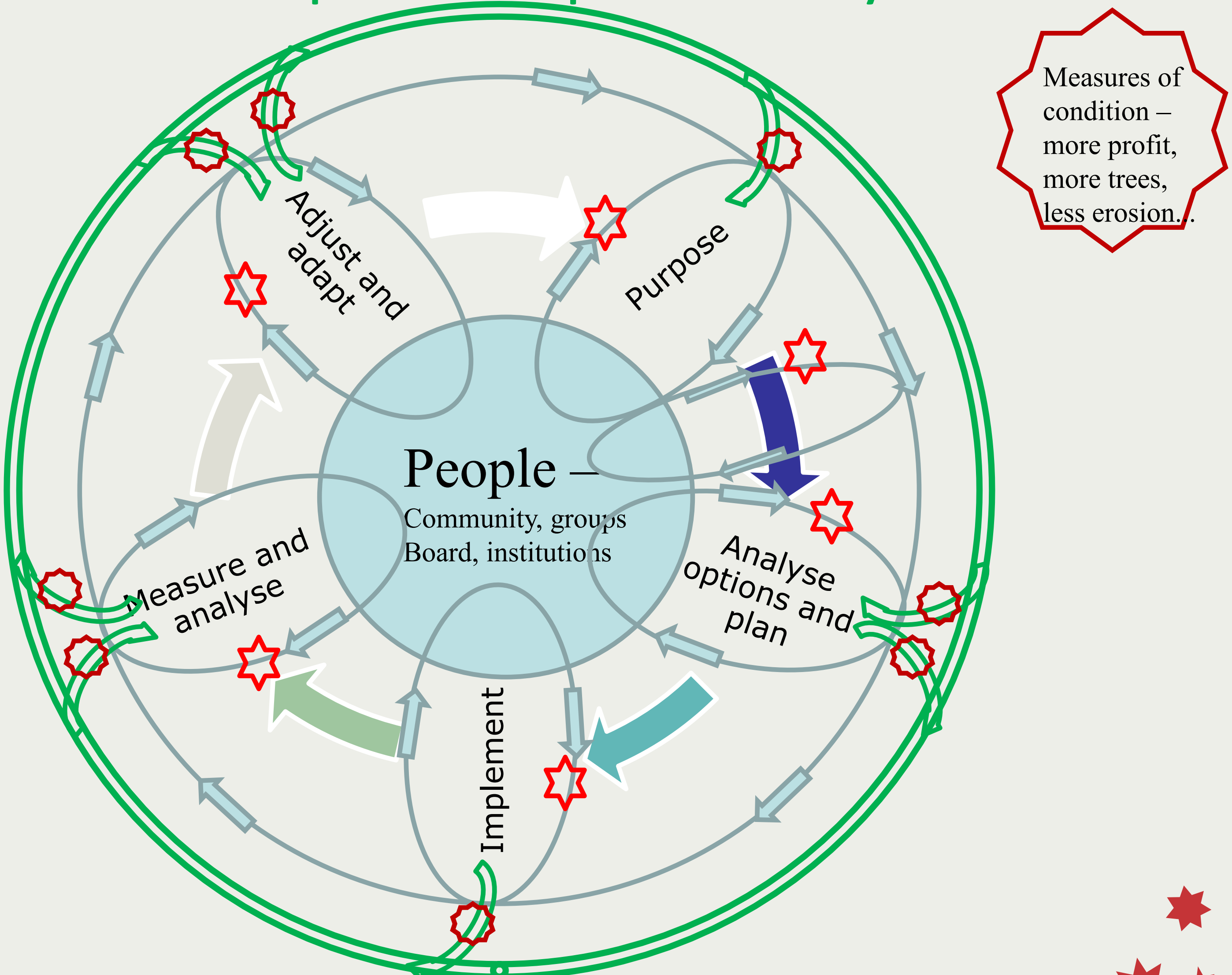


Community and institutional involvement

Use technical input to inform and test



Technical input – landscape futures analysis



Community and institutional involvement