INCORPORATING ECOSYSTEM SERVICES INTO THE AUSTRALIAN ECONOMY

Investing in a new and sustainable future

CSIRO

Australia's suite of environmental problems:

- Rising salinity in rivers
- Rapid expansion of saline soils
- Increasing areas of acid soils
- Algal blooms in waterways
- Loss of biodiversity

CSIRO

Why?

Past focus on production - livestock, crop yields, timber - without recognising other effects (or considering them as collateral damage):

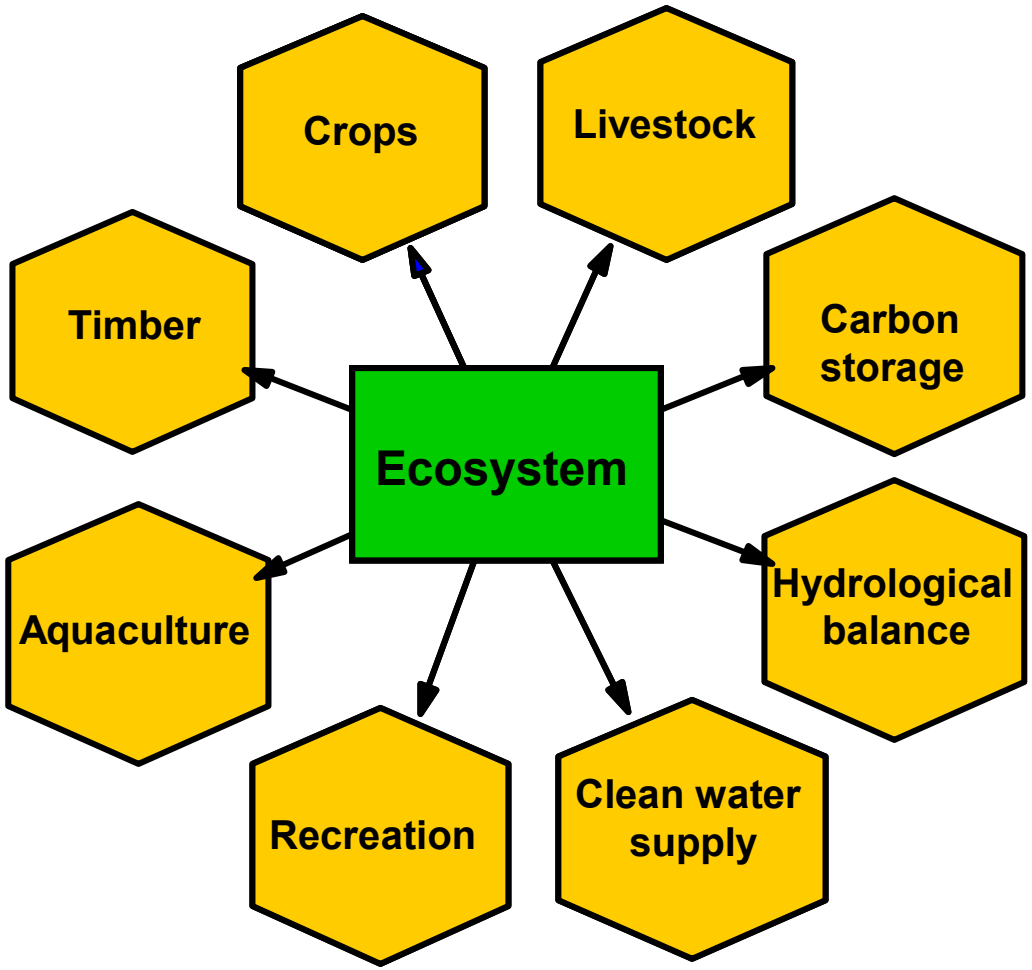
- **Off-site (down-slope) negative impacts**
- **On-site loss of other benefits**

CSIRO

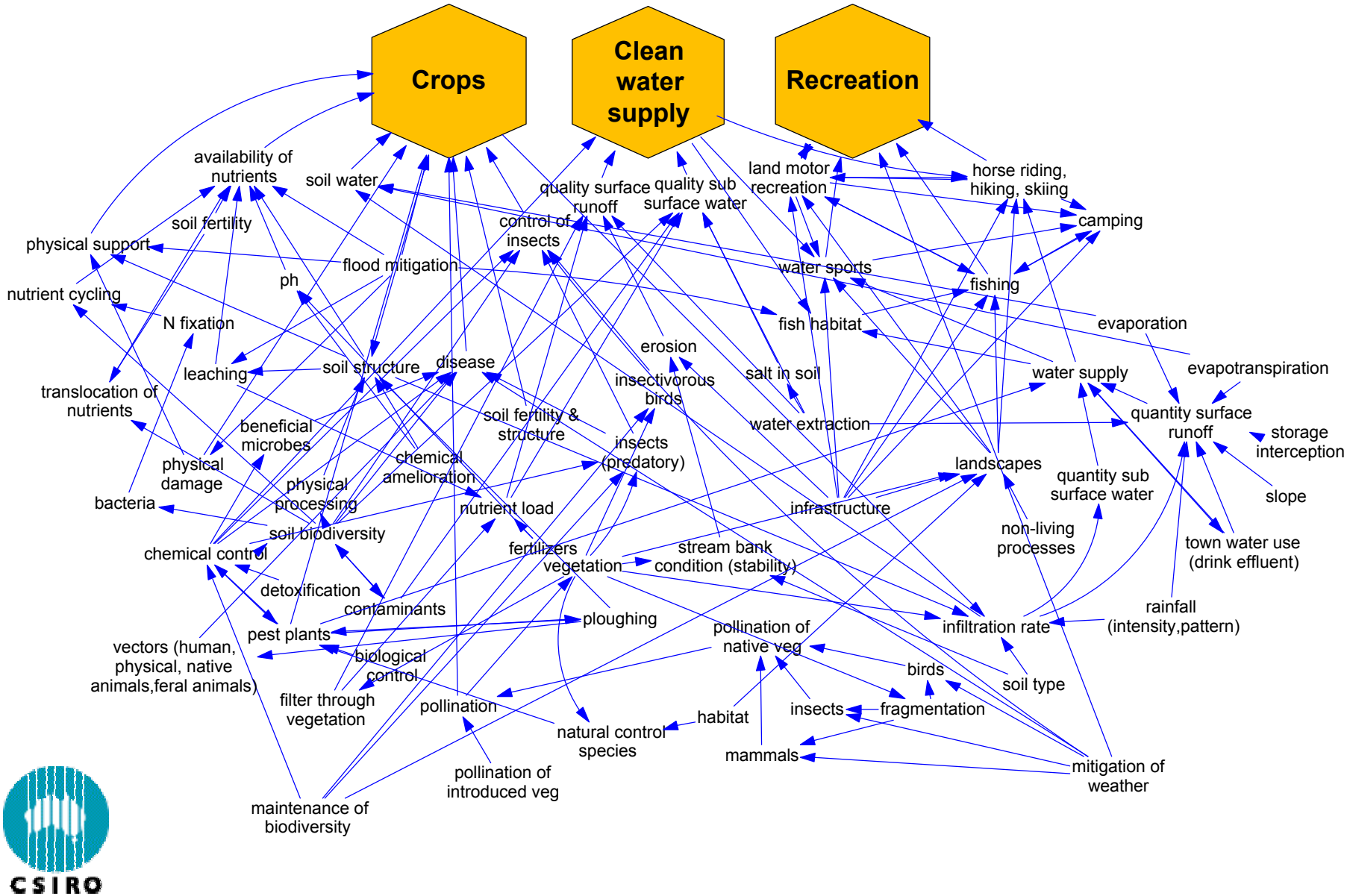
On-site benefits from ecosystem services

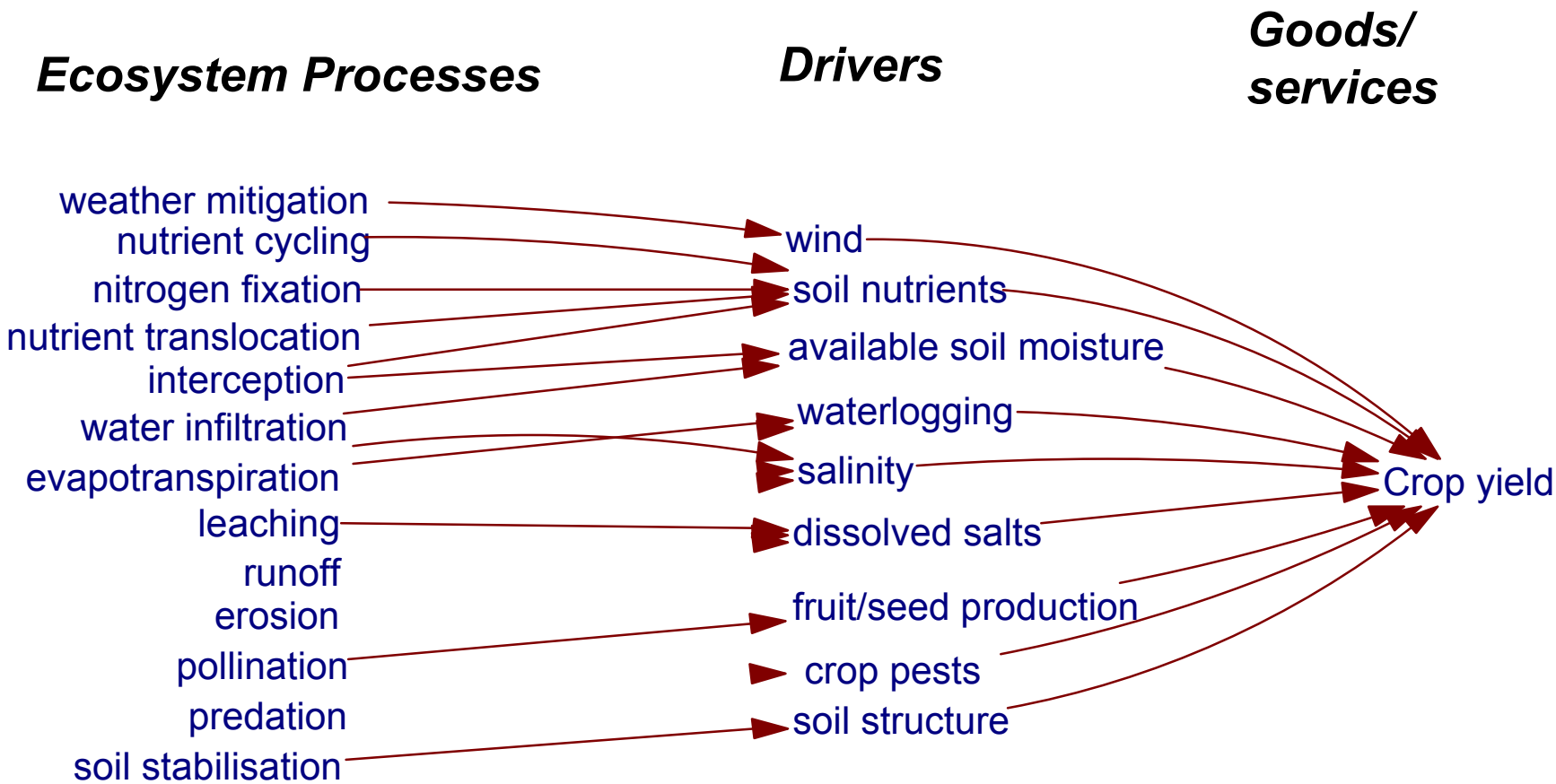
- Pest control
- Pollination
- Soil fertility maintenance
  - Nitrogen fixation
  - Nutrient cycling
  - Soil structure
  - Acid neutralisation
- Flood control
- Resilience (eg in rangeland production)

CSIRO

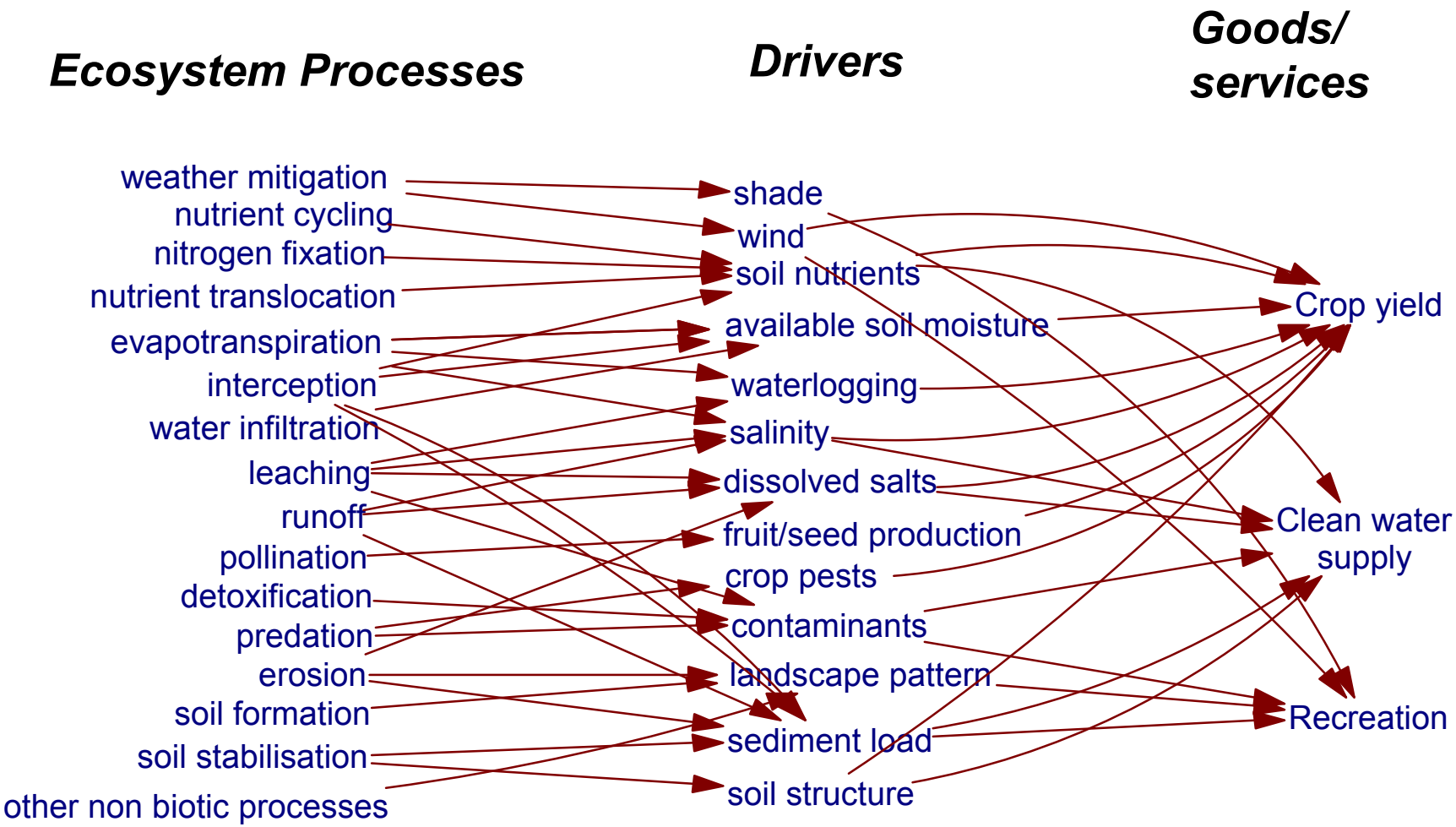

Crops
Livestock
Timber
Carbon storage
Ecosystem
Aquaculture
Hydrological balance
Recreation
Clean water supply

CSIRO


Crops
Clean water supply
Recreation
availability of nutrients
soil water
quality surface runoff
quality sub surface water
land motor recreation
horse riding, hiking, skiing
camping
soil fertility
control of insects
physical support
flood mitigation
water sports
ph
fishing
nutrient cycling
N fixation
fish habitat
evaporation
erosion
leaching
soil structure
disease
salt in soil
water supply
evapotranspiration
translocation of nutrients
insectivorous birds
soil fertility & structure
water extraction
quantity surface runoff
storage interception
beneficial microbes
insects (predatory)
physical damage
chemical amelioration
landscapes
quantity sub surface water
physical processing
slope
bacteria
nutrient load
infrastructure
soil biodiversity
non-living processes
town water use (drink effluent)
chemical control
fertilizers
stream bank condition (stability)
vegetation
detoxification
contaminants
rainfall (intensity,pattern)
ploughing
infiltration rate
pest plants
pollination of native veg
vectors (human, physical, native animals,feral animals)
biological control
birds
soil type
filter through vegetation
pollination
habitat
insects
fragmentation
natural control species
mammals
mitigation of weather
pollination of introduced veg
maintenance of biodiversity
CSIRO


Ecosystem Processes
Drivers
Goods/ services
weather mitigation
nutrient cycling
nitrogen fixation
nutrient translocation
interception
water infiltration
evapotranspiration
leaching
runoff
erosion
pollination
predation
soil stabilisation
wind
soil nutrients
available soil moisture
waterlogging
salinity
dissolved salts
fruit/seed production
crop pests
soil structure
Crop yield

CSIRO


Ecosystem Processes
Drivers
Goods/ services
weather mitigation
nutrient cycling
nitrogen fixation
nutrient translocation
evapotranspiration
interception
water infiltration
leaching
runoff
pollination
detoxification
predation
erosion
soil formation
soil stabilisation
other non biotic processes
shade
wind
soil nutrients
available soil moisture
waterlogging
salinity
dissolved salts
fruit/seed production
crop pests
contaminants
landscape pattern
sediment load
soil structure
Crop yield
Clean water supply
Recreation

CSIRO

Recognition of ecosystem services in the market place calls for three things:

(i) systematic characterization of ecosystem services;

(ii) integration of ecological and economic approaches to valuation; and

(iii) creation of institutions to incorporate these values into decision-making and to reward good stewardship (property rights, taxes, LandCare, …).

CSIRO

For any regional scale anaylsis we need:

- **a quantitative cataloguing of the sources and consumers of ecosystem services**

- **the production functions for producing each good and service, and the interactions amongst them, with special attention to:**
  - non-linearities and threshold effects
  - time lags between benefits of consumption and costs of lost services

CSIRO

Biodiversity conservation vs. ecosystem services

- **Investment in biodiversity conservation is based mainly on perceived growth in the value of the capital asset**

- **Investment in ecosystem services can be based on both capital asset appreciation and natural dividends that have economic value.**

any one service may not have sufficient option value to warrant foregoing existing resource use

but

packaging complementary services? e.g., carbon credits, salinity control and flood control may all accrue from the same investment

CSIRO

The Nature and Value of Australia's Ecosystem Services

How much is a bit of Australian nature worth?

THE MYER FOUNDATION

THE SIDNEY MYER FUND

CSIRO

THE SIDNEY MYER CENTENARY CELEBRATION 1899 - 1999

Four regional case studies

- An agricultural heartland region (The Goulburn-Broken valley in Victoria)
- A rangeland region (western NSW)
- A tropical mixed land-use region (The Atherton tableland)
- A forested catchment for a major population centre (still to be selected – perhaps part of the Sydney water catchment)

CSIRO

APPROACH

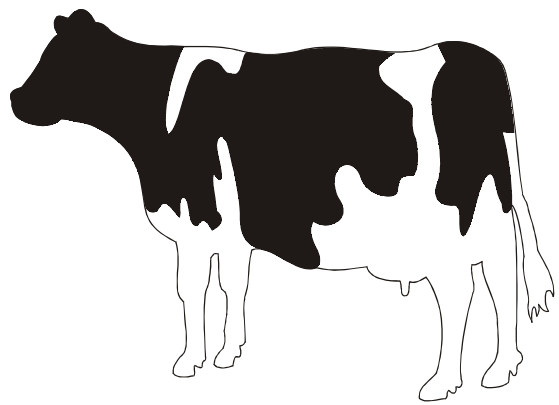
- Establish fully representative stakeholder groups for each region.
- Determine the catalogue of ecosystem goods and services considered to be important, using stakeholder information and scientific input.
- Determine, for each good and service, the catalogue of (dis)beneficiaries – at local, regional, state, national and even global scales.
- Develop a production function for each good and service - the simplest models of the set of drivers that determine the levels of services, or production of goods.
- Develop a model of the interactive effects amongst the drivers and the components of the various production functions.
- Establish the present set of land-uses and management regimes, “set” the drivers accordingly, and use the model to yield the present flow of goods and services.
- Select contrasting scenarios of feasible future changes in land use, including a more intensive version of present land use, and determine the future flows of goods and services for each scenario.
- Undertake an economic evaluation of the flows of goods and services.
- Analyse the results for trade-offs between goods and services, winners and losers, and identify the policy and management implications.

Land Uses	Management actions	Ecosystem processes	Ecosystem services	Drivers	Goods / services	Clients	Markets
Crop 1	ploughing	nutrient cycling	maintaining soil fertility	available soil nutrients	wheat yield	wheat board	world markets
Crop 2	cultivation	nitrogen fixation	detoxification	soil moisture	wool prod.	wool board	Australian markets
Livestock/pasture	direct drilling	nutrient accumulation	pest control	contaminants	milk prod.	dairy board	
Irrigated dairy	fertilising	microbial activity	water filtration	damage to crops	meat prod.	abattoir	
Timber	weedicide use	infiltration/runoff	provision of shade	animal health	timber	Japanese steel company	
– native	pesticide use	percolation	reduction in wind speed	pasture production	c-credits	pulp company	
– plantation	tree felling	erosion	amelioration of temperature	pasture quality	salinity credits	specialty Aust timber merchants	
Native vegetation	irrigation	leaching	resistance against invasion	water quality	biodiversity credits	philanthropic trusts	
Recreation 1	stocking	insect predation	regulation of hydrology	•	clean water	water board	
Recreation 2	flood control levees	regional/global climate regulation	carbon store	•	•	cost sharing for catchment mgmt..	
Recreation …..	fencing	local climate regulation	•	•	•	•	
Water catchment	shelter belt (planting)	•	•	•	•	•	
•	introduction of exotic pasture spp	•	•	•	•	•	
•	introduction of exotic tree spp	•	•			•	
•	provision of infrastructure	•					
•	•						
•	•						
	•						

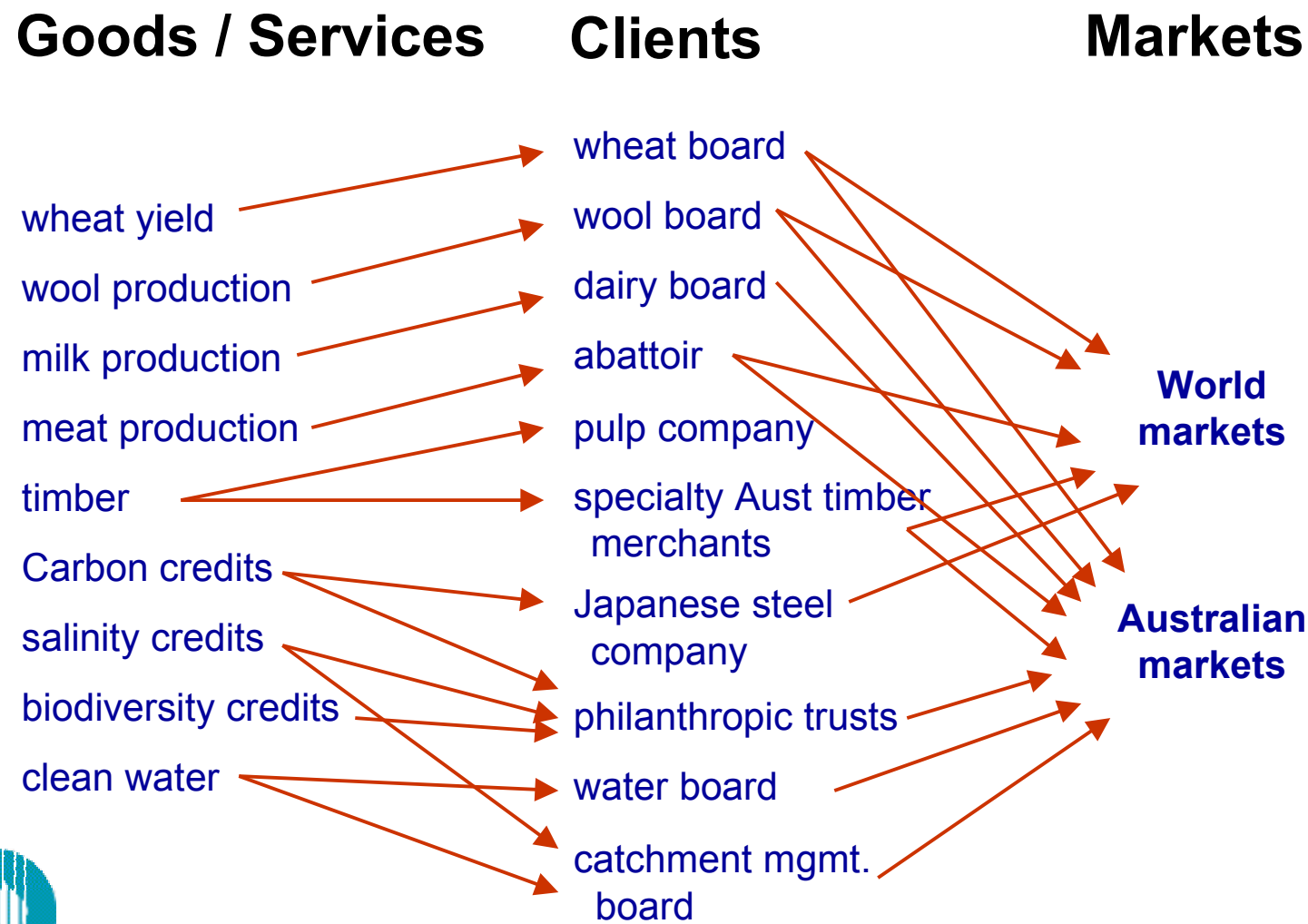
CSIRO

Irrigated dairy farming

Land Use	Management actions	Ecosystem processes	Ecosystem services	Drivers	Goods	Clients	Markets
Irrigated dairy	introduction of exotic pasture spp. storage of surface water fertilising waste disposal weedicide use irrigation planting of shelter belts fencing stocking with cows • •	nutrient cycling nitrogen fixation nutrient accumulation microbial activity infiltration/runoff erosion leaching insect predation filtering local climate regulation • •	maintaining soil fertility detoxification pest control reduction in wind speed provision of shade regulation of hydrology water filtration • •	pasture prod. pasture quality animal health	milk prod.	dairy board	world markets Australian markets



CSIRO


Goods / Services
Clients
Markets
wheat yield
wool production
milk production
meat production
timber
Carbon credits
salinity credits
biodiversity credits
clean water
wheat board
wool board
dairy board
abattoir
pulp company
specialty Aust timber merchants
Japanese steel company
philanthropic trusts
water board
catchment mgmt. board
World markets
Australian markets

To advance investment and trading in ecosystem services will require:

- more knowledge about their nature and value

2. resolution of property rights so that:
   - rights can be separated from products
   - different goods and services can be quantified,marketed and sold separately

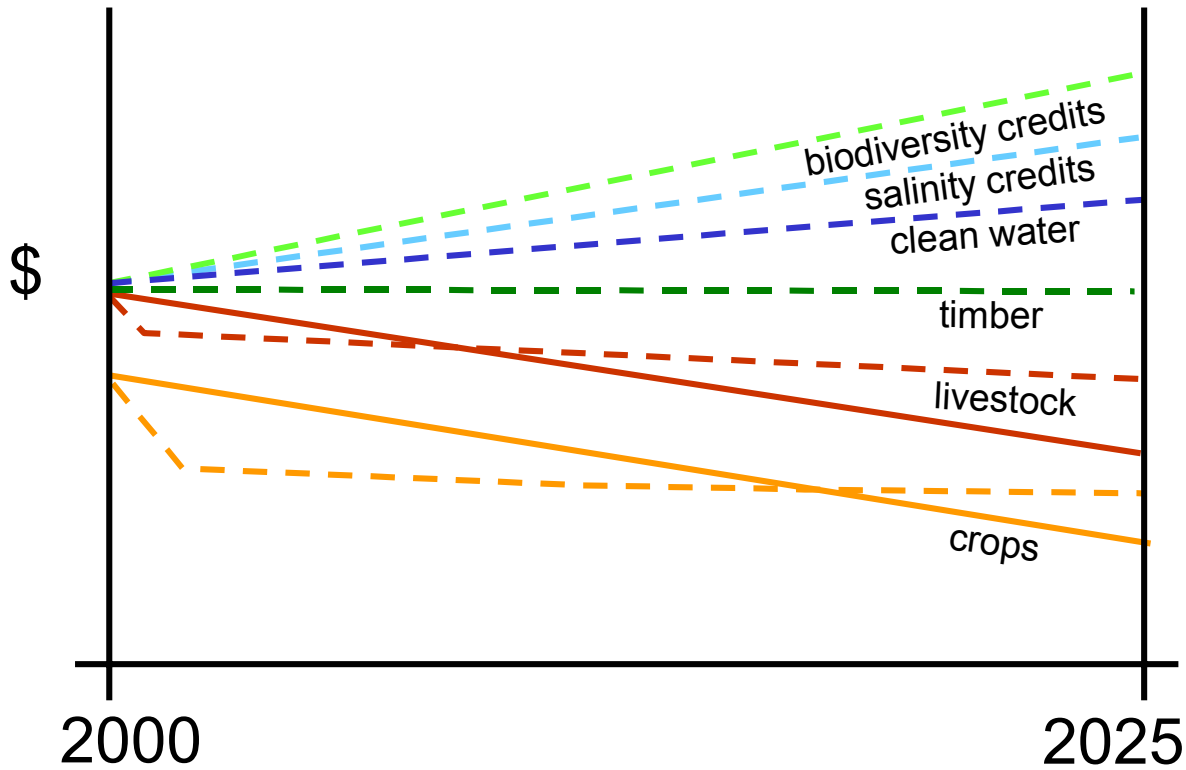
3. design of financial mechanisms to enable stewards of ecosystem services to realise the value of the services they provide

(sorting out 2 will likely be the most difficult)

CSIRO

What will the economy of a region look like under a future policy of investment in ecosystem services?

CSIRO



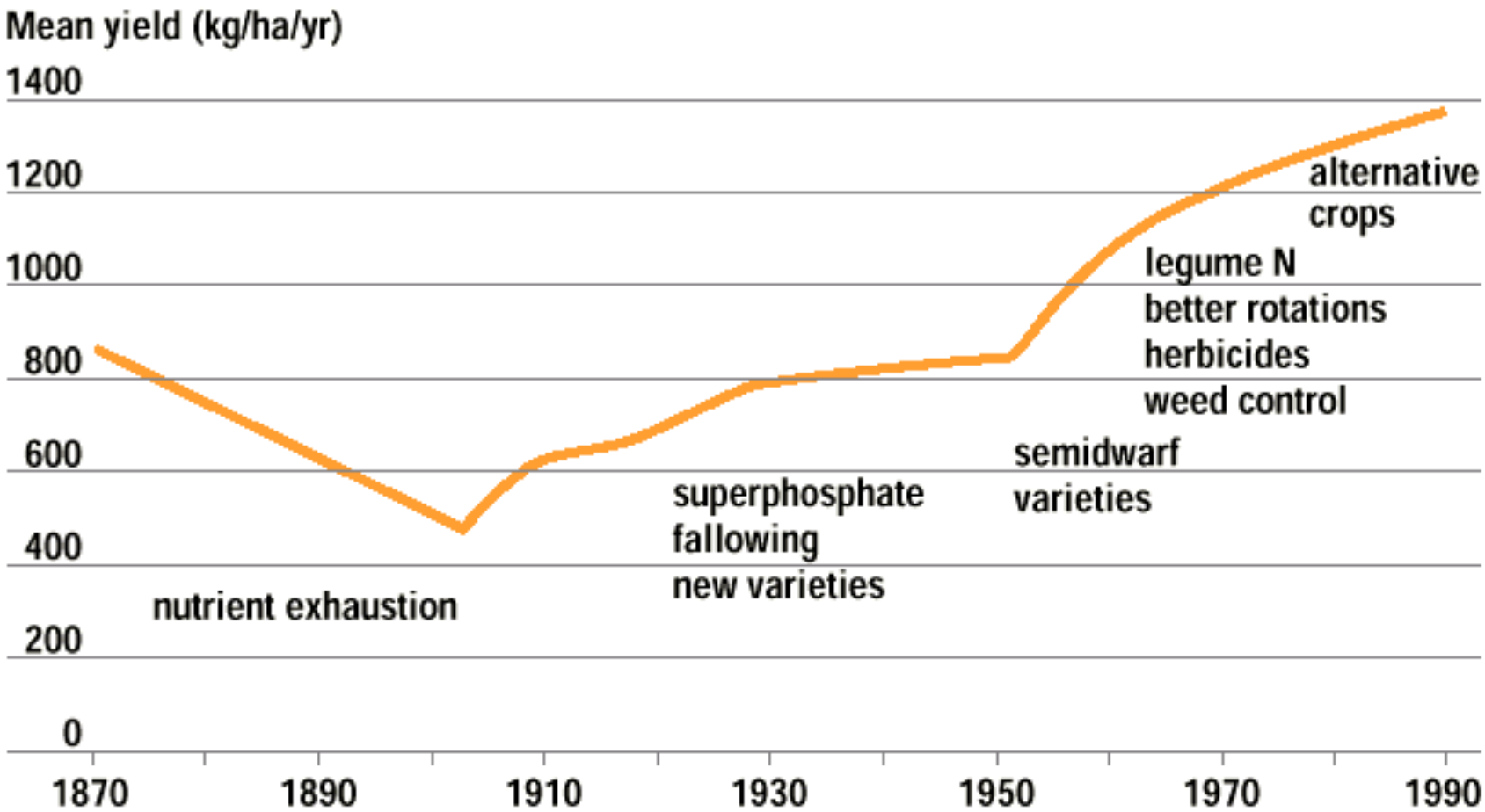
Hypothetical regionally averaged trends in value of “production”, including the effects of technology, commodity prices and ecosystem sustainability.

business as usual

multiple goods and services

CSIRO

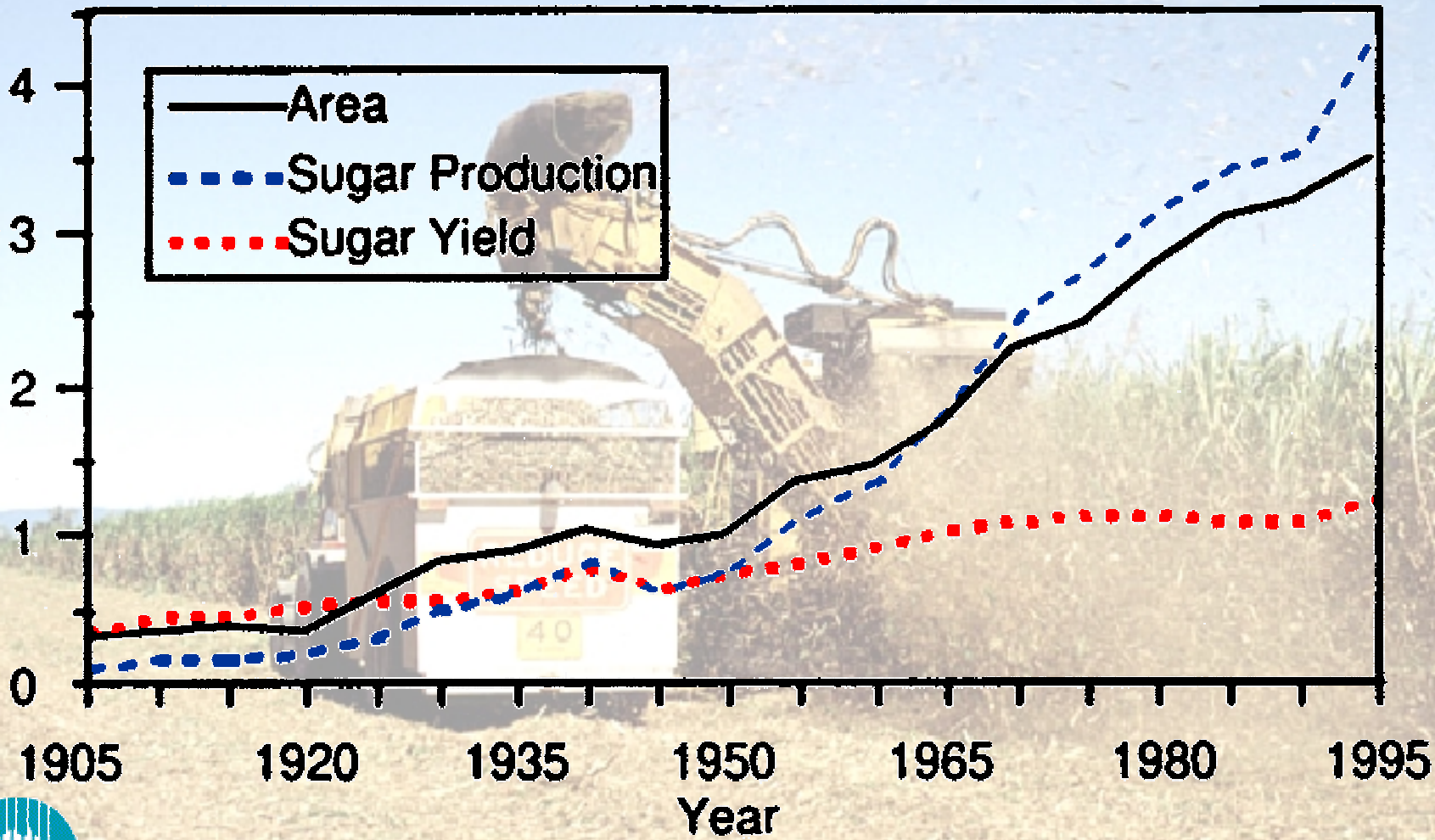
Australian wheat yields



Source: Hamblin and Kyneur, 1993.

CSIRO

Sugar production and yield



Garside A.L etal (1997)

CSIRO

In the context of natural capital Australia has two distinctive features:

- **The oldest, eroded, leached land surface with far less self-repairing capacity than the recently glaciated, fertile soils of the northern hemisphere. It is less forgiving of bad management.**

- **One of seven "megadiverse" nations in the world - a rich and unique biota, evolved over 60 million years of isolation.**

The trends are evident.

There is opportunity for the private sector, with backing from Government, to take advantage of them and, by so doing, avoid the looming, costly hazards