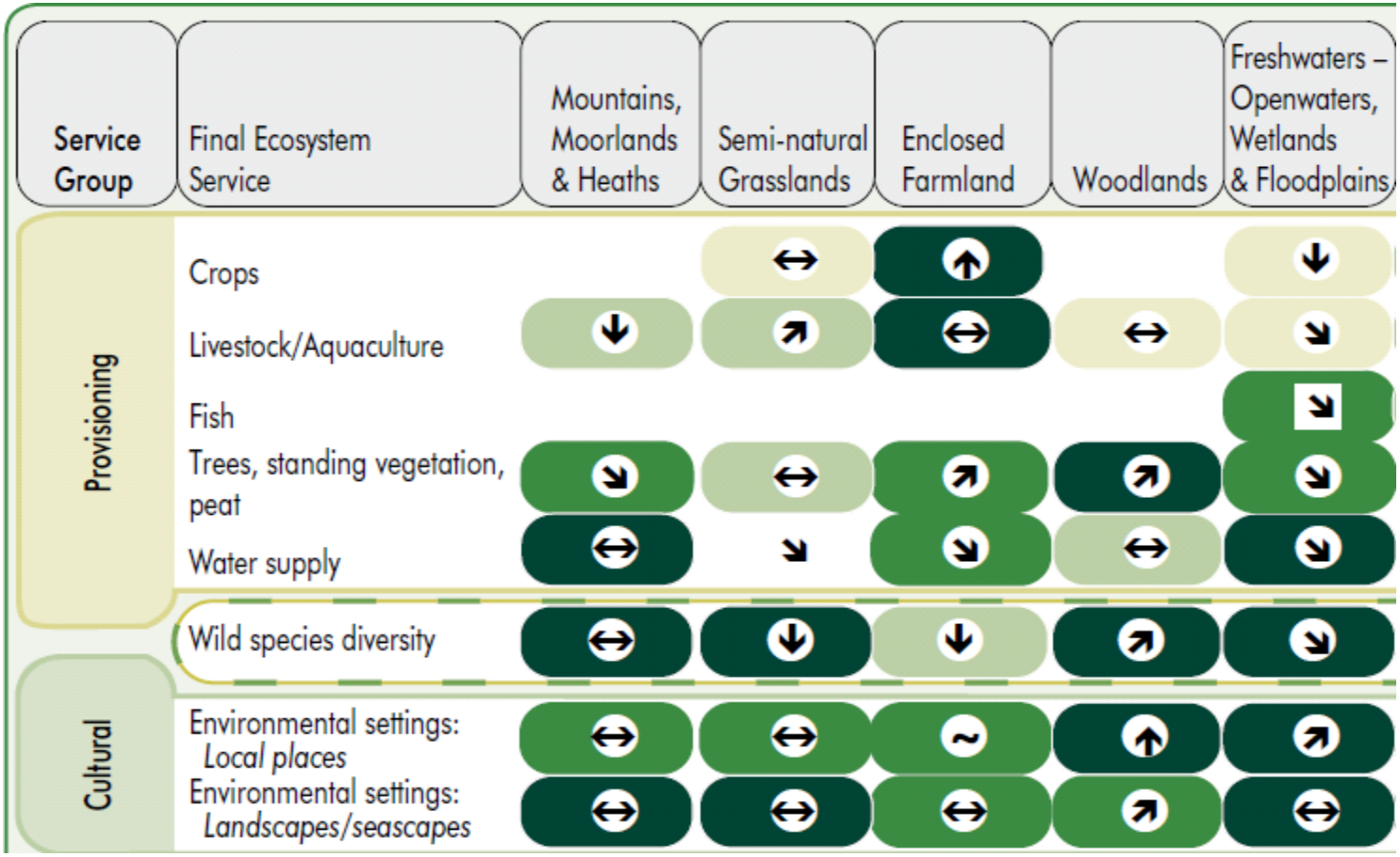
Putting the economics into ecosystem accounting

Presented by: Sofia Ahlroth
Date: February 23, 2015

Learning objectives

- Different ways to put economics into ecosystem accounts
- Ecosystem accounting requires exchange values
- Distinguish suitable methods for valuing *ecosystem services* and when to apply them
- Distinguish suitable methods for valuing *ecosystem assets* and when to apply them

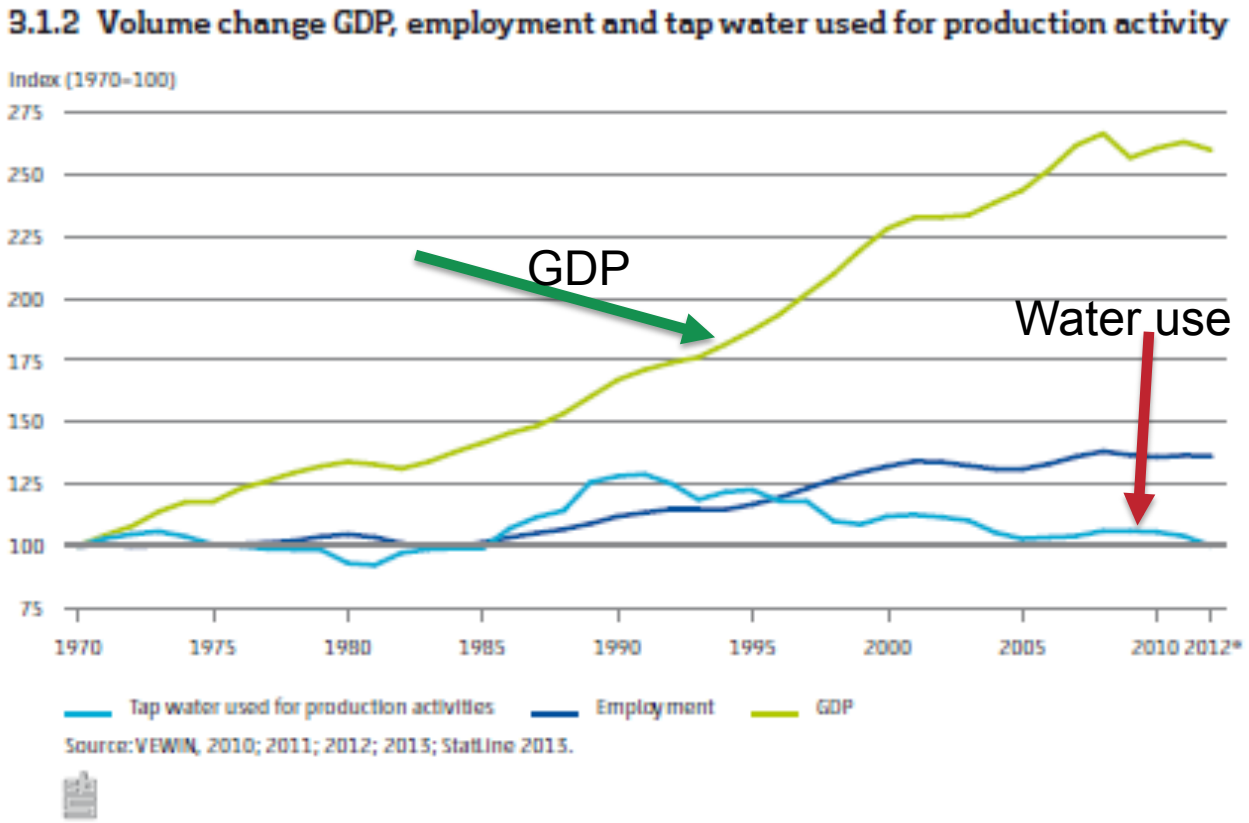
Qualitative versus quantitative descriptions



How to put economics into accounting

Physical vs. monetary descriptions

- Physical information useful in itself
- Prerequisite for valuation



Why value?

To integrate environmental issues in economic decision making and development planning

Valuation is fit for purpose:

Different contexts require different value concepts

1. Assessment of welfare:

E.g. cost benefit analysis, focus on utility

2. Assessment of economic activity:

E.g. National accounts, focus on exchange value

Exercise:

Suppose you have 10 currency units, and you need to buy 1 bread, 1 kg of rice, and 1 kg of fish. Indicate your how much you like to pay for 1 kg of rice!

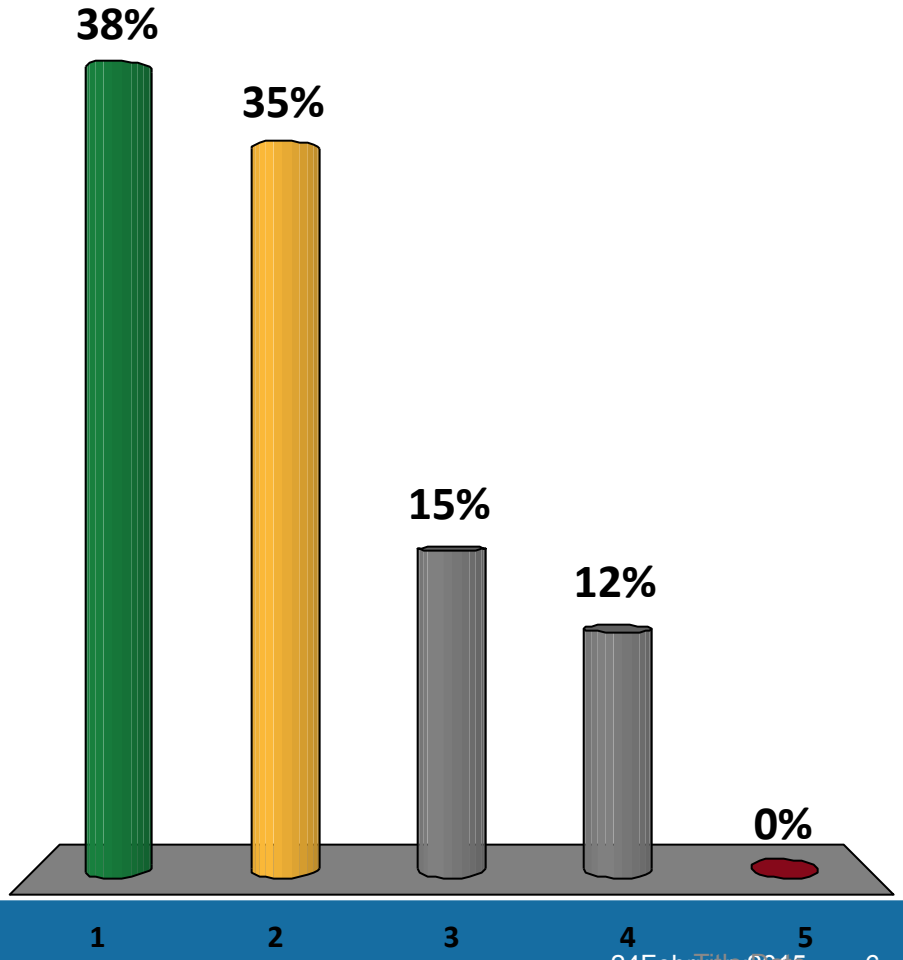
A. 1 unit

B. 2 units

C. 3 units

D. 5 units

E. 7 units



Valuation methods for ecosystem accounts

Suitable methods: identify or generate exchange values

- Should build on physical accounts

Unsuitable methods:

- Include consumer surplus
- Unable to value individual services (e.g. restoration)
- Simple benefit transfer approaches (“big numbers”)

Problems with global benefit transfer studies

articles

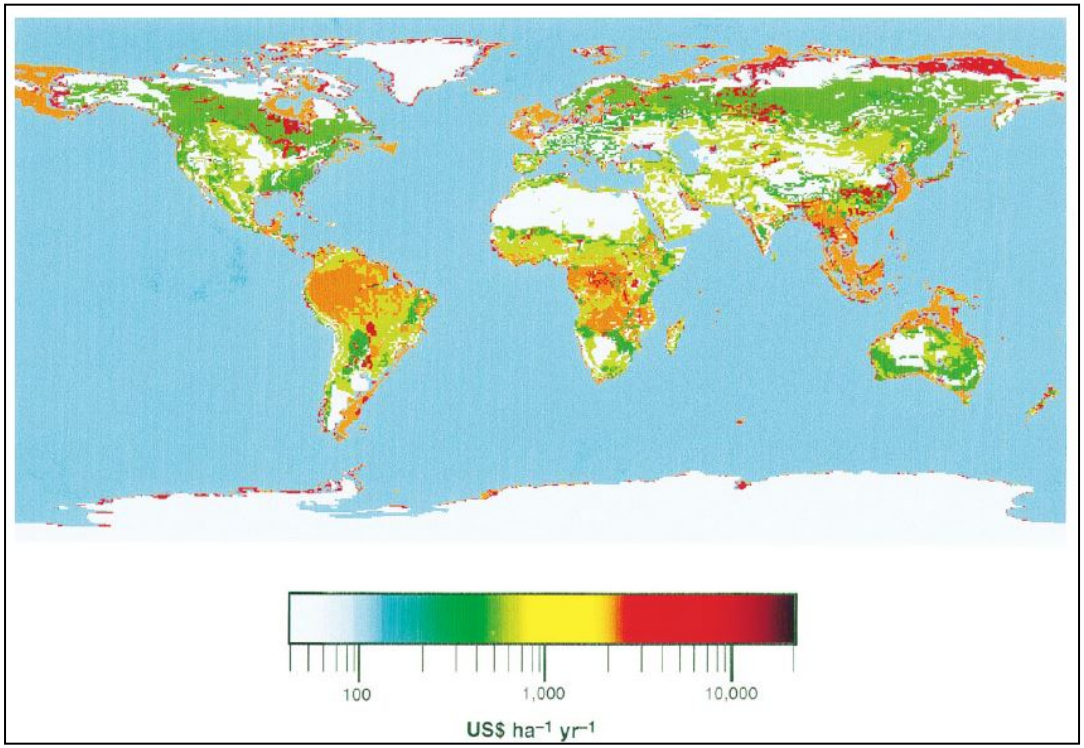
The value of the world's ecosystem services and natural capital

Robert Costanza*†, Ralph d'Arge‡, Rudolf de Groot§, Stephen Farber‖, Monica Grasso†, Bruce Hannon¶, Karin Limburg#*, Shahid Naeem, Robert V. O'Neill††, Jose Paruelo‡‡, Robert G. Raskin§§, Paul Sutton‖‖ & Marjan van den Belt¶¶**

* *Center for Environmental and Estuarine Studies, Zoology Department, and † Institute for Ecological Economics, University of Maryland, Box 38, Solomons, Maryland 20688, USA*
‡ *Economics Department (emeritus), University of Wyoming, Laramie, Wyoming 82070, USA*
§ *Center for Environment and Climate Studies, Wageningen Agricultural University, PO Box 9101, 6700 HB Wageninengen, The Netherlands*
‖ *Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, Pennsylvania 15260, USA*
¶ *Geography Department and NCSA, University of Illinois, Urbana, Illinois 61801, USA*
# *Institute of Ecosystem Studies, Millbrook, New York, USA*
** *Department of Ecology, Evolution and Behavior, University of Minnesota, St Paul, Minnesota 55108, USA*
†† *Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA*
‡‡ *Department of Ecology, Faculty of Agronomy, University of Buenos Aires, Av. San Martin 4453, 1417 Buenos Aires, Argentina*
§§ *Jet Propulsion Laboratory, Pasadena, California 91109, USA*
‖‖ *National Center for Geographic Information and Analysis, Department of Geography, University of California at Santa Barbara, Santa Barbara, California 93106, USA*
¶¶ *Ecological Economics Research and Applications Inc., PO Box 1589, Solomons, Maryland 20688, USA*

The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet. We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of

"For the entire biosphere, the value… is estimated to be in the range of US $16-54 trillion per year… Global gross national product total is around US $18 trillion per year."



High values where no beneficiaries are located (Siberia)

Three different principles for generating exchange values

1. Price of similar good or service

2. Estimate how much of the value of marketed goods or services are due to ecosystem services

3. Estimate cost of not having the ecosystem service

Objects of valuation

Ecosystem services

- Flows: during the year

Ecosystem capital

- Assets: stocks at beginning/end of year and changes therein

Ecosystem capital provides ecosystem services

- Can be multiple services
- Can be multiple beneficiaries

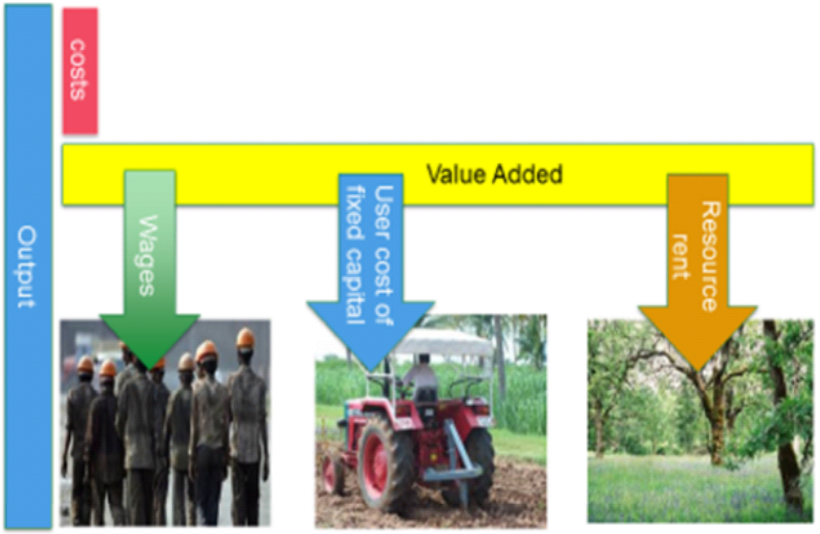
Provisioning services

1. Proxy market prices

- The exchange value of a similar product on the market

2. Resource rent (RR)

- Value added seen as return to all assets used in production
- RR is a residual that measures return to ecosystem



Regulating services

1. Market prices

E.g. PES, REDD

2. Avoided damage cost

Damages if service not available

E.g. flood protection from mangroves

3. Replacement costs

Labor+capital of least cost alternative

e.g. constructing breakwaters

4. Production function

Isolate effect of input of service on output

$$Y = MFP(t) * F(C, L, E)$$

Production function

$$Y = MFP(t) * F(Capital, Labor, ecosystem\ asset)$$

MFP = Marginal Factor Productivity

Value of coastline protection and erosion prevention

Average cost of constructing breakwaters: $ 875 per m

75-m-width mangroves protecting the shoreline would yield per hectar for a 20-year period (at a discount rate of 10 %) **$ 12,300**

But this is an over-estimation!

Taking into account that around 30 % of the coastal areas would actually be worthwhile such an investment, the amount reduces to **$ 3,700**

(Sathirathai and Barbier, 2001)

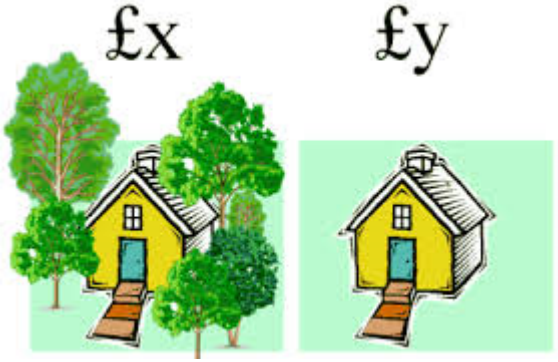
Cultural services

Hedonic pricing method

Estimate effect of amenities on property prices

Travel cost approach

Impute values through opportunity cost (time and goods)



How to choose your method?

1. **Is there a direct (proxy) market value for the service?**

   Use this value (with adjustments)

2. **Is there a market good to which the service contributes?**

   Product: resource rent or production function

   Asset: resource rent or hedonic price method

3. **If not, choose method based upon:**

   Type of service you are valuing (regulating / cultural)

   Data availability

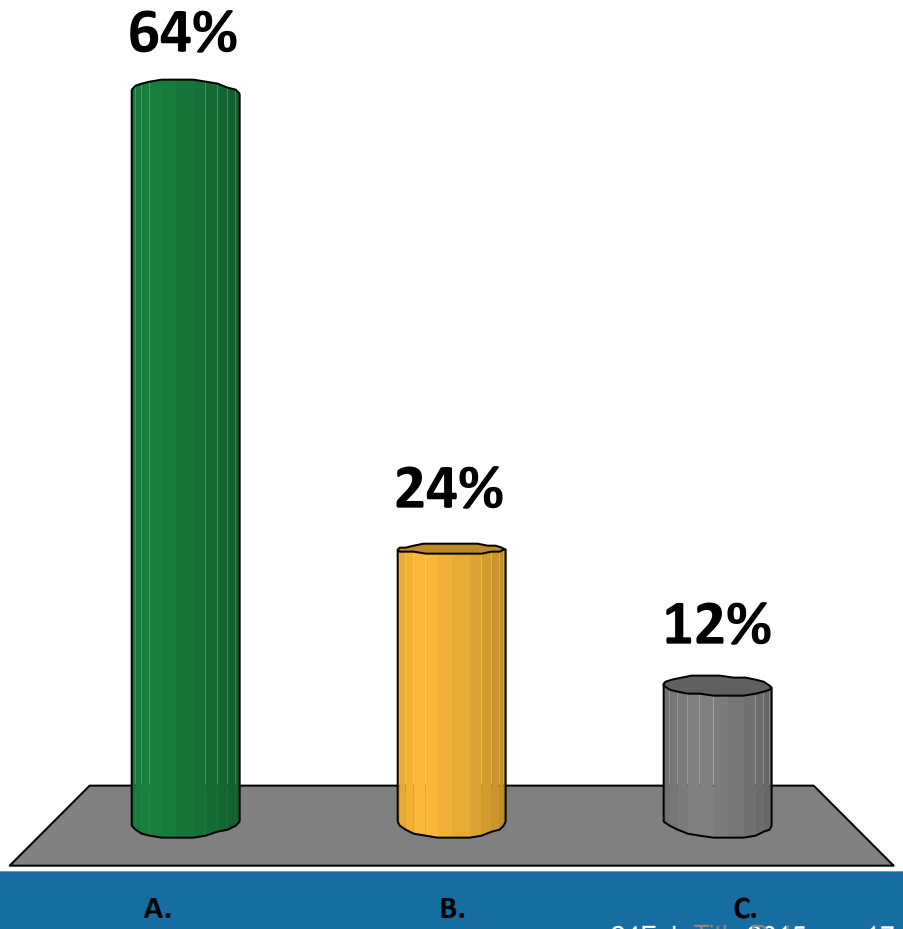
Inserting into accounts

Let's say we have valued the water provisioning services from forests to farmland with the resource rent method, on a national scale. Now we want to integrate this value into the national accounts. How do you think that would affect GDP?

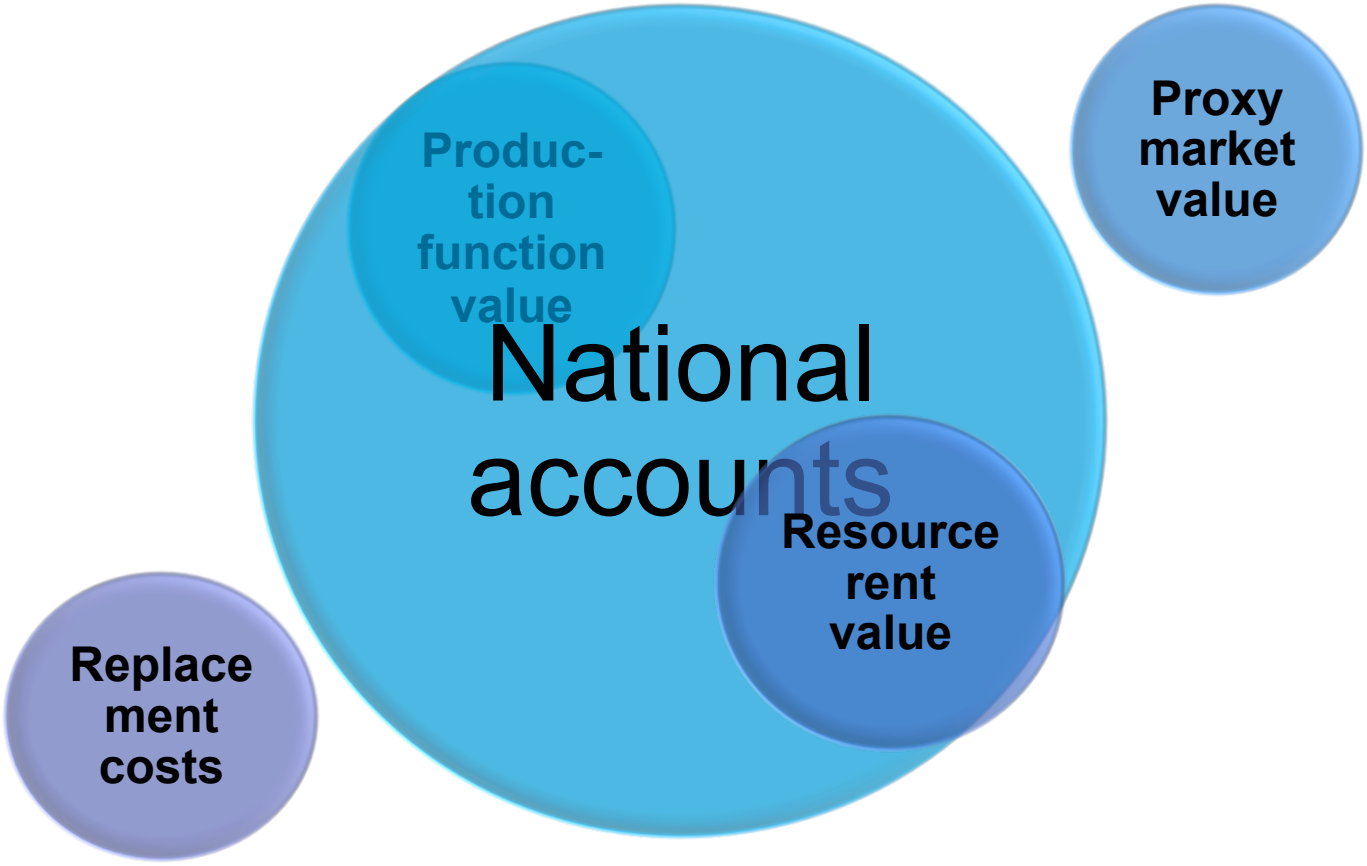
A. GDP would be higher

B. GDP would stay the same

C. GDP would fall



Inserting into accounts



Valuation of ecosystem assets

- Market (e.g. fish quota rates, insured value)

- Net Present Value of flows from the asset

$$NPV = ES_0 + \sum_{t=1}^{\infty} ES_t / (1+$$

Net present value

The value of the asset equals the discounted flow of services from the asset

Current values	t0	t1	t2	Sum
ES1	40	30	35	
ES2	60	40	20	
Total, undiscounted	100	70	55	225
Total, discounted	100	64	45	209

$$NPV = 100 + 70/(1+0.1) + 55/(1+0.1)2 = 209$$

Resource rent - Example from Namibia

Objective: assess the value of mineral resources

Why: assess the extent to which minerals are being used to build a sustainable economy.

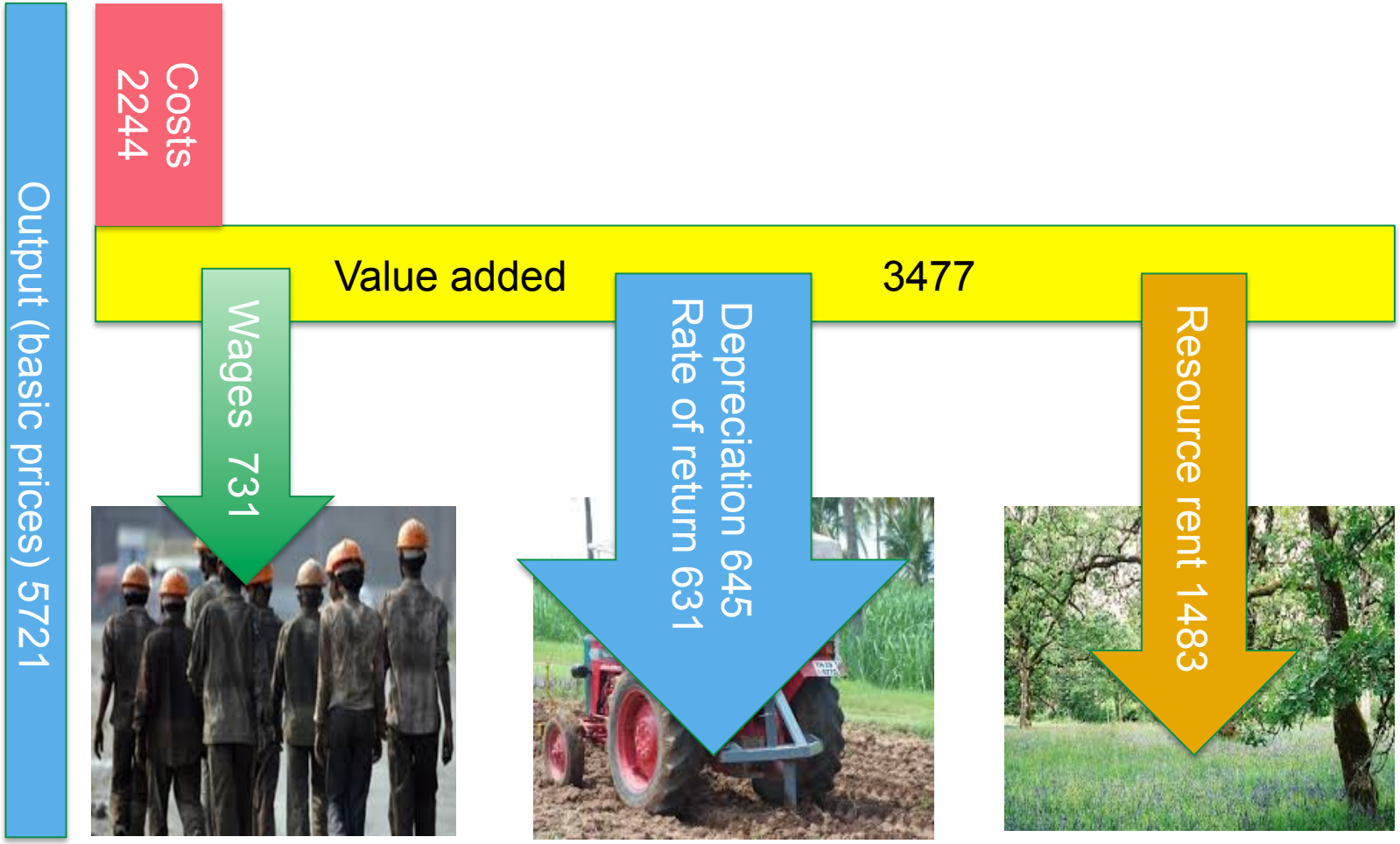
Choice of method:

- **No market transactions available for mineral deposits**
- **Provisioning service: statistically observable = value added of companies engaged in extraction -> resource rent approach**

Data sources:

- Physical data about reserves / extraction etc.
- Company data about revenues, costs, fixed assets etc.

Resource rent - Namibia



Balance sheet: Example from Australia

Some assets valued through market prices

Others as NPV

The value of land may reflect a range of ES, but not all (externalities)

$ Billions	Jun-2013
Total assets	10742
Non-financial	9378
Produced	4880
Non-produced	4498
Natural resources	4495
Land	3619
Mineral and energy resources	863
Standing timber	2
Spectrum	12
Permissions to use natural resources	3
Financial assets	1364
Total liabilities	2158

Source: 5204.0 Australian System of National Accounts

Exercise: balance sheet

What is the importance of land for Australia's net worth? (Net worth = total assets less total liabilities)

Suppose we are able to value all ecosystem services.

Make list of possible ecosystem services and what valuation method could be used to value them.

How would that be included in the balance sheet?

Exercise : resource rent

Estimate the resource rent for a hypothetical farm using the following data:

- Sales: 500
- Seeds, fertilizers 40
- Wages: 200
- Value of machinery 400; remaining lifetime 10 years
- Rate of return 8 %
- Investment: 50
- Product based tax: 10

Key messages

Various ways of accounting for ecosystem services

- Qualitative vs. quantitative
- Physical vs. monetary

When valuing always keep context in mind:

- Exchange value is the unifying concept within the SNA
- Object of valuation: ES or ecosystem capital
- Flows: p*q (volumes derived from biophysical modelling)

A range of feasible valuation methods exists

- Choice of method depends on service and data availability