Economic instruments for the sustainable provision of land resources: soil, water and fodder

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Outline

1. Introduction: state of the problem and research questions
2. Main problems in implementing economic tools for the sound management of forest resources
3. Case studies
4. Conclusions

1. Introduction

Introduction: state of the problem

- MED-MENA: negative environmental effects due to an intensive use of natural resources:
  - forest degradation
    - Loss of natural forest cover, less than 1% of land area covered by natural forest (Perman et al., 2003)
  - soil erosion
  - water scarcity
  - loss of biodiversity
  - *forage potential reduction*

- MED-SE: negative environmental effects due to:
  - farm land and forest land extensivation and abandonment
  - land development (mainly costal areas), with locally an increased pressure on forests by tourism, recreation, …

  → fire
  - forest degradation
  - soil erosion
  - water scarcity
  - loss of biodiversity
  - *loss of cultural landscapes*

Different driving forces, quite similar impacts, but at different scale

Economic causes of degradation

- In MENA, farmers and local forest users **maximize** their **current commercial incomes** from an intensive use of natural resources at present (subsistence economy)
- In all Med areas, **costs of degradation** are not considered
- Investment for sustainable management induces **low direct returns** , but could generate higher benefits for society:
  - local- and national-scale externalities: increased soil fertility and water capacity, …
  - global-scale externalities: biodiversity protection, Carbon sequestration, …

Research questions

- **Why economic instruments are needed to induce sustainable management ?**
  - Comparison of the **farmers' income and degradation costs** between current and sustainable use/ management
  - Comparison between **private and social** net benefits
- **How environmental services are addressed by economic instruments ?**

  Identification of the potential to finance the environmental benefits through **economic instruments** and **market-based mechanisms**

2. Main problems in implementing economic tools for the sound management of forest resources

Mixed forest services, time span, scale

- Not only the traditional **mixed dimension** (public and private) of forest services

  and the **time span problem** (short-term financial revenues vs. long-term economic benefits)

but also

- the **scale dimension** of the benefits and costs perception …

Measurability of land use effects by scale

Impact Type	Basin size [km²]						
	0.1	1	10	10^2	10^3	10^4	10^5
Average flow	x	x	x	x	–	–	–
Peak flow	x	x	x	x	–	–	–
Base flow	x	x	x	x	–	–	–
Groundwater recharge	x	x	x	x	–	–	–
Sediment load	x	x	x	x	–	–	–
Nutrients	x	x	x	x	x	–	–
Organic matter	x	x	x	x	–	–	–
Pathogens	x	x	x	–	–	–	–
Salinity	x	x	x	x	x	x	x
Pesticides	x	x	x	x	x	x	x
Heavy metals	x	x	x	x	x	x	x
Thermal regime	x	x	–	–	–	–	–

Legend: x = Measurable impact; – = No measurable impact

Source: FAO Land and Water Bulletin 9, 2000

Failure to consider full economic values

- Non market benefits and off site effects are not usually considered
- Difficuty to measure the land use effects on soil erosion and sedimentation for large basins

Institutional arrangements

- Not only the traditional **mixed dimension** (public and private) of forest services

  and the **time span problem** (short-term financial revenues vs, long-term economic benefits)

but also

- the **scale dimension** of the of benefits and costs perception …

- … and thus the problems related to institutional arrangements to implement the principle "**who benefits, pays**" → Payment for Env. Services (**PES**)

Types of market-based payments for water provision services (Perrot-Maître & Davis, 2001)

- **Voluntary Contractual Arrangements**

  = direct negotiations between water users and landowners

  → *La Esperanza hydropower producer pays the NGO Monteverde Conservation League for maintaining existing forest cover in the upper catchments - Costa Rica*

- **Trading Schemes**

  = trade of "credits" between companies and landowners for exceeding the requirements on water use or pollution limits

  → *The Tam-Pamlico Trading Program in USA*

- **Public Payment Schemes**

  = direct payments to farmers/forest owners for management practices that protect water quality

  → *Council Regulation 1698/2005 for Rural Development 2007-2013 (Axis 2)*

A classification for PES for water provision

	Voluntary Schemes	Compliant-based Schemes	Government-mediated Schemes
Main driving forces	Profit (business) Public Relation strategy, Corporate Social Responsibility (CSR)	Governmental laws/regulations	Public authority role in providing environmental - ecosystem services (with no or limited market) to the community
Main payment mechanism	Service's suppliers (forest owners or managers) directly paid by service's end-users for forest management specifically oriented to provide the service (ex, recreation)	Service's suppliers (forest owners or managers) indirectly paid by service's end-users for maintaining the forest functions	Service's suppliers (landowners) indirectly paid by public authorities (responsible towards the general public -> end-users) for forest management specifically oriented to provide the service (ex, quality of water),
Main instrument	Contractual agreements, tickets to access the recreational area,	Property rights regulations by selling picking permits	water tariff paid by water end-users + public funds allocation policies

Based on: Johnson *et al*, 2001; The Katoomba Group, 2008; Wunder *et al,* 2008

Types of economic instruments

- Incentives and grants
- Compensations
- User charge /fees / natural resources taxes
- Market-based mechanisms (Negotiated agreements, Marketing of environmental services, certification)

In addition, institutional arrangements are needed for resources allocation (access conditions, etc.)

3. Case studies

(A) Cork oak management (Tunisia)

(B) Bou Hertma e Marguellil watershed investments (Tunisia)

(C) Tap water provision by Val Nossana spring (Italy)

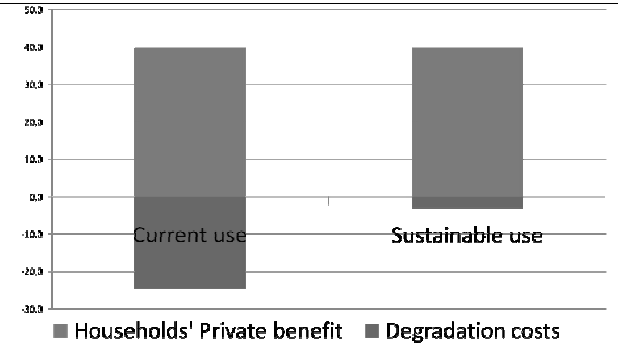
Case study (A): Cork oak forest management

- Lack of clearly defined property rights:
  - State owner has the exclusion rights on land uses, but local households have free access for livestock grazing, firewood and NWFP harvesting
  - Management guided by rational management aims for land owner, and by maximizing the current commercial income for local users

Methodology

- Comparison between current and sustainable use:
  - households' benefits
  - degradation costs from a private and social perspective
  - social net benefits
- Comparison between current and sustainable management:
  - Households' benefits
  - government revenue

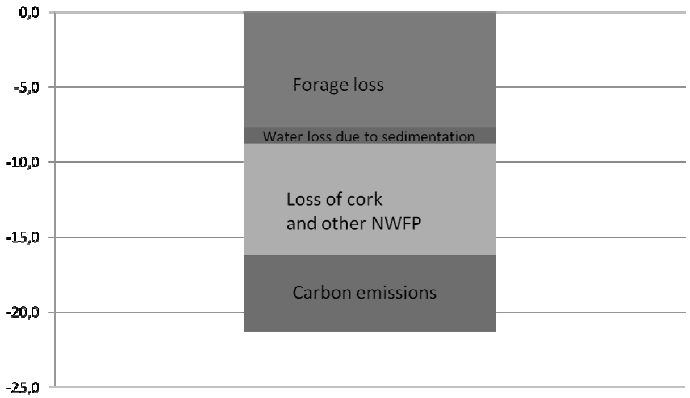
Comparison of degradation costs between current and sustainable use (€/ha, 2005)



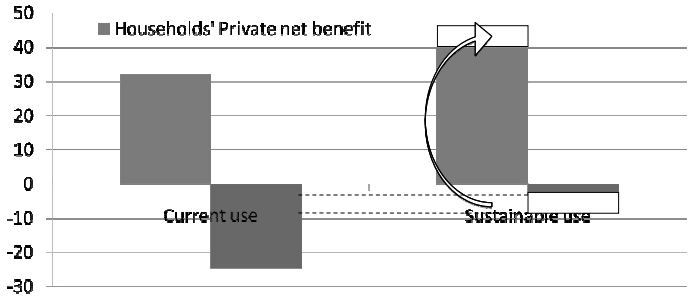
- Degradation costs related to open access, and insufficient enforcement of existing rules,

Source : Daly et al,, 2007, Comparison between private and social benefits of the Tunisian cork oak forest

Degradation costs for the current use (€/ha, 2005)



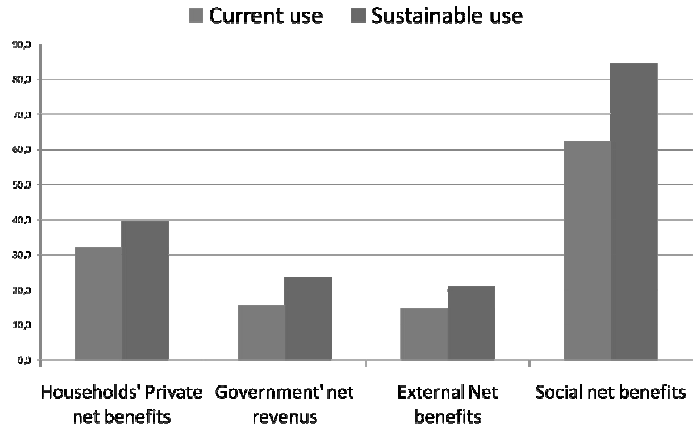
Economic impact of subsidies (€/ha, 2005)



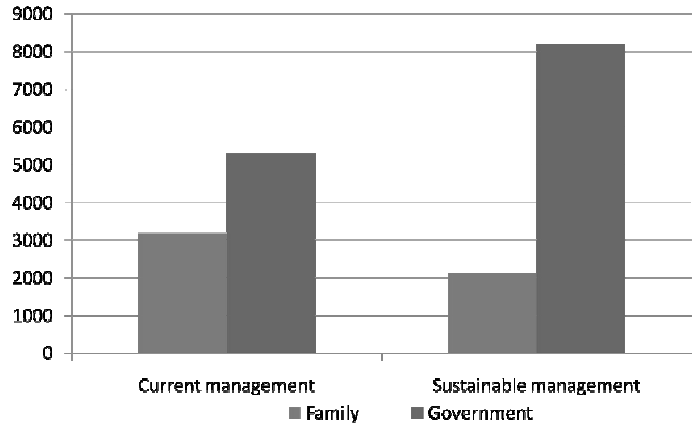
- Need for mechanisms for forage allocation and incentives for forest conservation
- Public owner and society are better off: avoid higher loss from current practice
- Farmers better off: more profit from sustainable use

Source : Daly et al,, 2007, Comparison between private and social benefits of the Tunisian cork oak forest

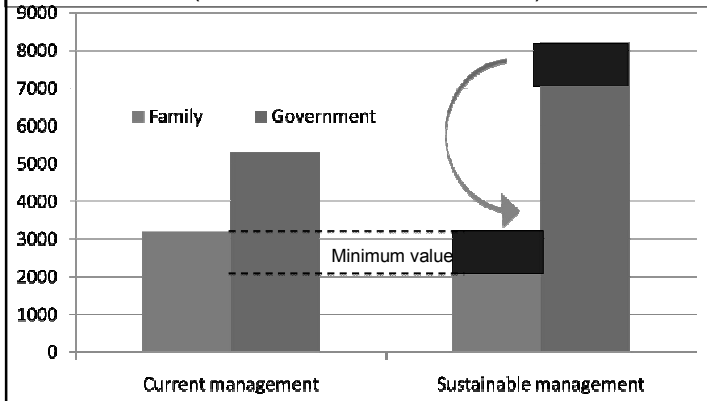
Comparison of private and social net benefits between current and sustainable use (€/ha, 2005)



Comparison of net value added between sustainable and unsustainable management (2002 €/ha; discount rate: 2%)



Economic impact of compensation (2002 €/ha; discount rate: 2%)



- Public owner is better off : higher net value added
- Farmers better off: more profit from sustainable management

Case study (B): Bou Hertma e Marguellil watershed investment

Planned investments (Bou Hertma)

Components	Area (or km)	Investments costs ($/ha)	Total costs ($)
Pine plantation for wood production	434	2,317	1,005,578
Plantations with mixed sp. for soil protection	190	1,368	259,920
Cork oak regeneration	837	242	202,554
Grazing land amelioration	1,017	2,039	2,073,663
Meadow management	110	1,299	142,890
Management of existing forests	685	353	241,805
Soil stabilization	280	550	154,000
Pine forests thinning	939	160	150,240
Forest roads construction	Km 44	Km 15,000	660,000
NWFPs	2,461	-	-
Total			**4,890,650**

Case study (B): Bou Hertma e Marguellil watershed investment

A step-wise approach

Effects	Financial Analysis (FA)	Conventional Economic Analysis (CEA)	Extended Economic Analysis (EEA)	Socio-Economic Analysis (SEA)
On site (for the residents)	*	*	*	*
Off site (external to the watershed)	—	—	*	*
Market	*	*	*	*
No market	—	—	*	*
Redistribution among stakeholders	—	—	—	*

Case study (B): Bou Hertma e Marguellil watershed investment

	Watershed	NPV (000 $)	IRR
FA	B	1 186 039	12.7%
	M	- 1 435 617	9.2%
	Total	**-249 578**	**9.9%**
CEA	Bou		19.9%
	Marg		13.9%
	Total	**10 408 557**	**15.4%**
EEA	Bou	6 231 660	23.3%
	Marg	10 534 898	17.6%
	Total	**16 776 558**	**19.1%**
SEA	Bou Hertma	9 325 018	28.0%
	Margu		21.6%
	Total		**23.1%**

Increased farm, wood and NWFPs production

Impact on accessibility (road construction), increased time span of the dam

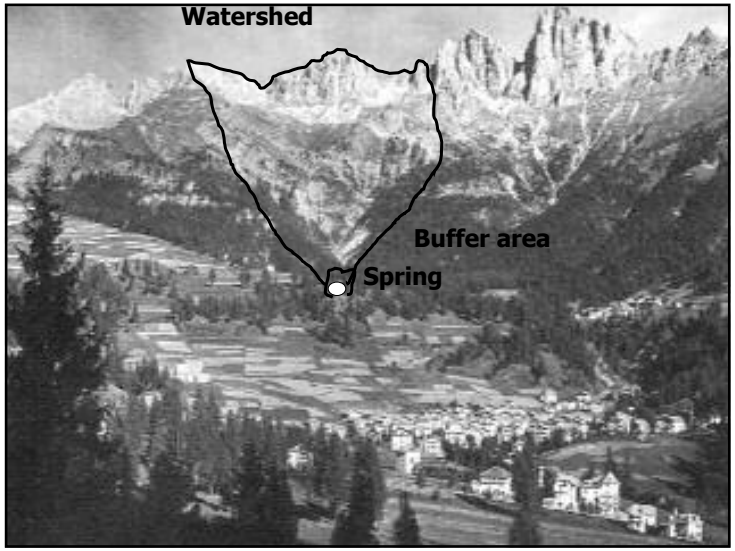
Impact on tourism
C sequestration
Water table recharge

Costs and benefits weighted for 3 groups of stakeholders: residents (1.5), farmers downstream (1.15) other (1.0)

Case study (C): Tap water provision by Val Nossana spring

What to evaluate?

- The product or service:
  - Water "produced" by the watershed
  - Water consumed
- Reference area:
  - Spring
  - Buffer area around the spring
  - Catchment area (watershed)

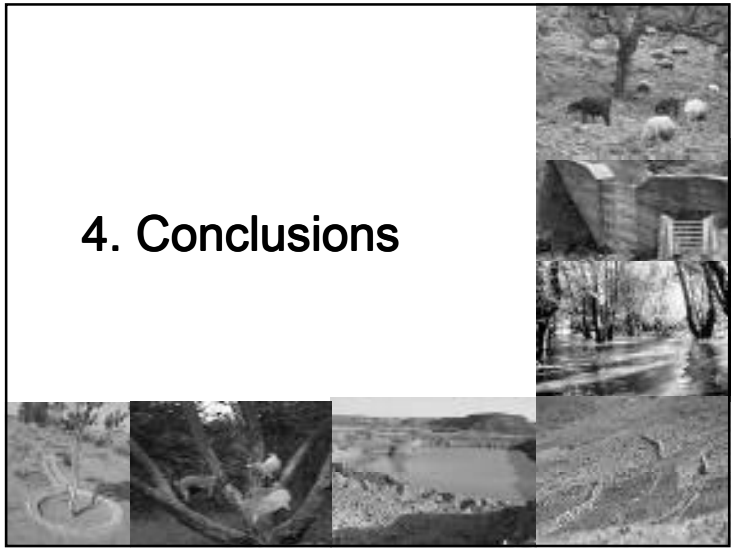


Case study (C): Tap water provision by Val Nossana spring

Methods		*Evaluation Criteria*	*Reference area*	*Reference market*	*Land value (€/ha)*	*Water value (€/mc)*
Indirect costs approaches	Ref. to land use	Market value	Buffer area	Land market vale	21,478	-
		Cost value		Plantation and management costs	12,159	-
		Opportunity cost		Revenue loss from alternative use of land	6,092	-
		Substitution costs		Meadow creation and management costs	9,657	-
Additional costs approaches		Cost value	Watershed	Additional management costs	10 - 50	0.0004 - 0.002
Approaches based on costs for the final consumers	Ref. to water use	Cost value	Watershed	Management costs	1,460 – 7,300	0.15 – 0.75
		Substitution costs		Water supply with alternative means (lorry transport)	-	0.000858
		Substitution costs		Water supply with alternative means (new aqueduct)	-	80.00
		Averting behavior		Alternatives to the use of water from aquifer	4,353 - 6,442	260.00 (1)
		Contingent valuation		Wtp/Wta for an aquifer protection programme	6,529 – 9,664	0.68 – 1.01

(1) Average cost of bottled mineral water: 0,26 €/l

4. Conclusions



Conclusions

- Including non market and off-site benefits in analysis can lead to different values of the profitability indicators
- Different evaluation methods can produce different economic results
- Forest investments have different income distribution

Need for standardized procedures and large data set of results → non distorted subsidies and compensation to offset the potential household income loss and to correct the market failures caused by externalities

Design and implement appropriate institutional arrangements

- External costs may be corrected through the use of **institutional arrangements**

Two problems:

1. To properly appreciate the value of the products and services
2. To create the mechanisms for payment