

EFI Scientific Seminar

Plantation forests to native forests: delivering multiple ecosystem benefits in a changing climate

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Assessing multiple-benefits from different types of forests (with a strong focus on plantations)

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Outline

- Some basic concepts
- Plantation outcomes: increase or decrease of the set of ES (Ecosystem Services)?
- Open questions

Slides can be download from the web: search “pettenella”

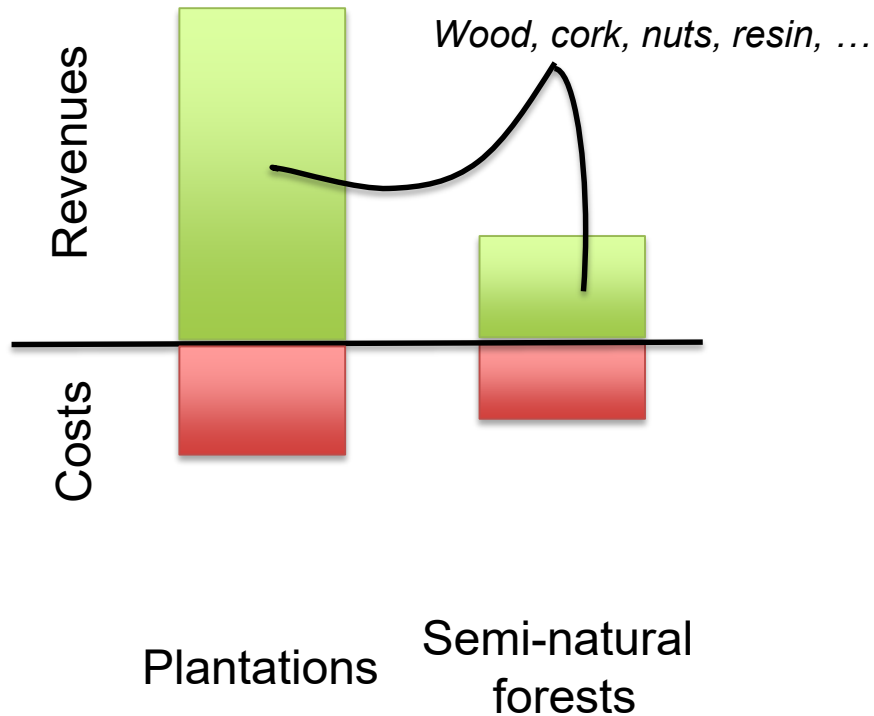
- **Some basic concepts**
- Plantation outcomes: increase or decrease of the set of ES?
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Financial vs. economic analysis

In **financial analysis**, all costs and revenues are valued according to their **market prices**

Economic analysis also considers **non-market impacts**, i.e. any positive or negative **externality** deriving from a project, and **shadow prices** can be used when market prices do not represent the true social values of inputs and outputs

Financial analysis



No systematic analysis of plantations profitability (financial analysis)

Timber investments returns from plantations in southwestern Europe

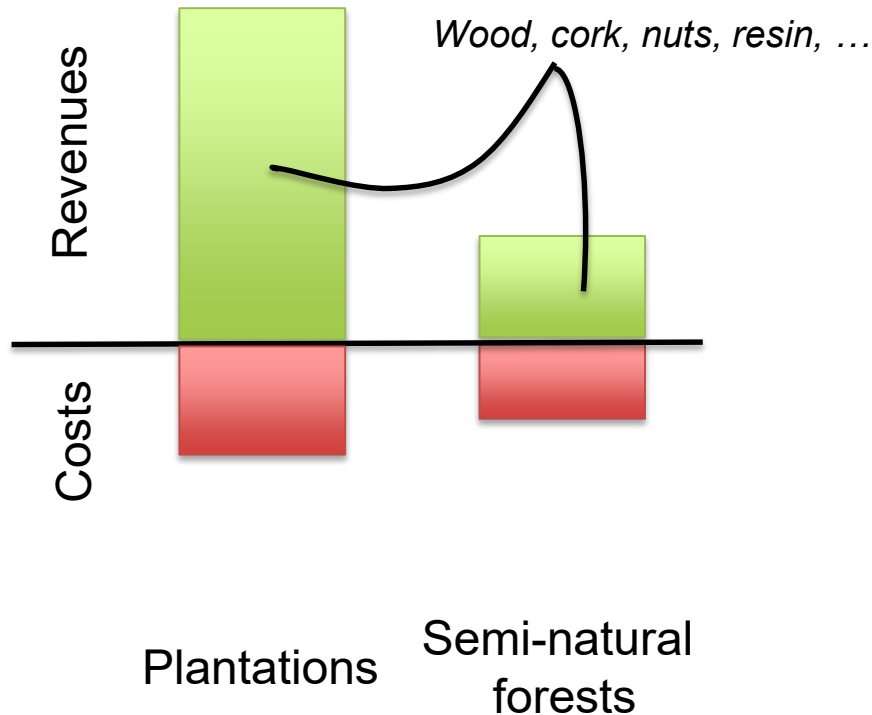
Country/area	Species	MAI (m ³ /ha/yr)	Rotation (years)	NPV* (EUR/ha)	IRR	Reference
Duero valley (Spain)	Hybrid poplar clone 'I-214'	10-25	14	1,954–8,338 (<i>i</i> =5%)**	-	Del Peso <i>et al.</i> (1995)
Spain	Hybrid poplar clones 'Campeador' and 'I-214'	24-40	10-13	2,312–9,406 (<i>i</i> =9%)**	11.3%-20.7%	Diaz Balteiro and Romero (1994)
Ebro valley (Spain)	Hybrid poplar clones 'I-MC' and 'I-214'	20-30	10-14	418–5,022 (<i>i</i> =4.25%)	4.5%-7.4%	Aunos <i>et al.</i> (2002)
France	Hybrid poplars	15	17	250–300 per year (<i>i</i> =2%)	7.5%	Vidal and Bequey (2008)
Spain and Portugal	<i>Eucalyptus globulus</i>	10-15	10-12	157–449 (<i>i</i> =6.5%)	7.0%-8.0%	King (2012)
Spain	<i>Pinus radiata</i>	14-21	30-38	-	5.8%-9%	Rodriguez <i>et al.</i> (2002)
Basque Country (Spain)	<i>Pinus radiata</i>	-	35	1,358 (<i>i</i> =3%)	<5%	Tolosana Esteban <i>et al.</i> (2013)
Italy	Hybrid poplar clone 'I-214'	-	10	-	2.0%-8.0%	Borrelli and Facciotto (1997)

* NPV is presented in nominal terms

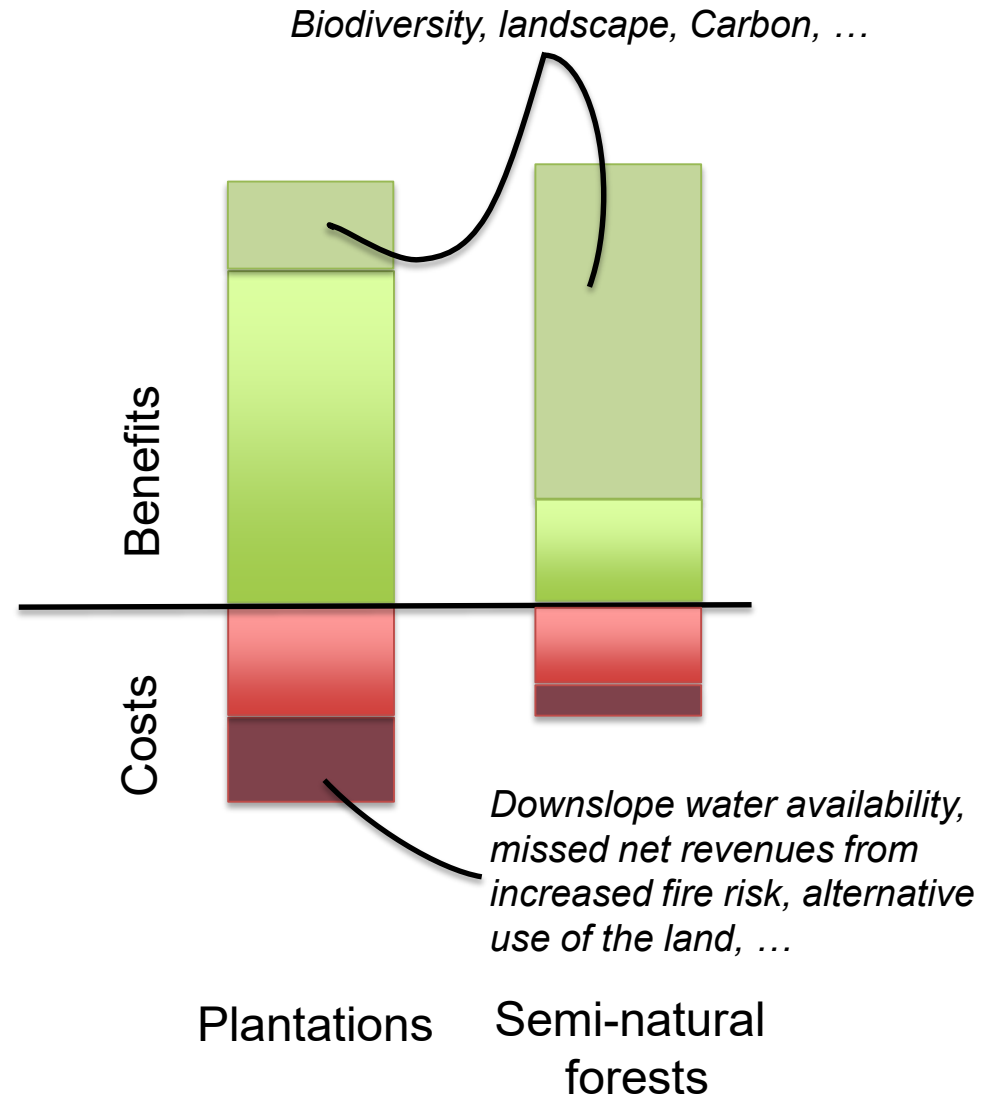
** Converted from Spanish Pesetas to Euros (166.386 ESP = 1 EUR)

Source: Forest plantations in Southwestern Europe: a comparative trend analysis on investment returns, markets and policies. A.Praa, M.Masiero, S.Barreiroc, M.Tomé, I.Martinez, G.Orradre, A.Onaindia, L.Brotto, D.Pettenella. Forest Policy and Economics (forthcoming)

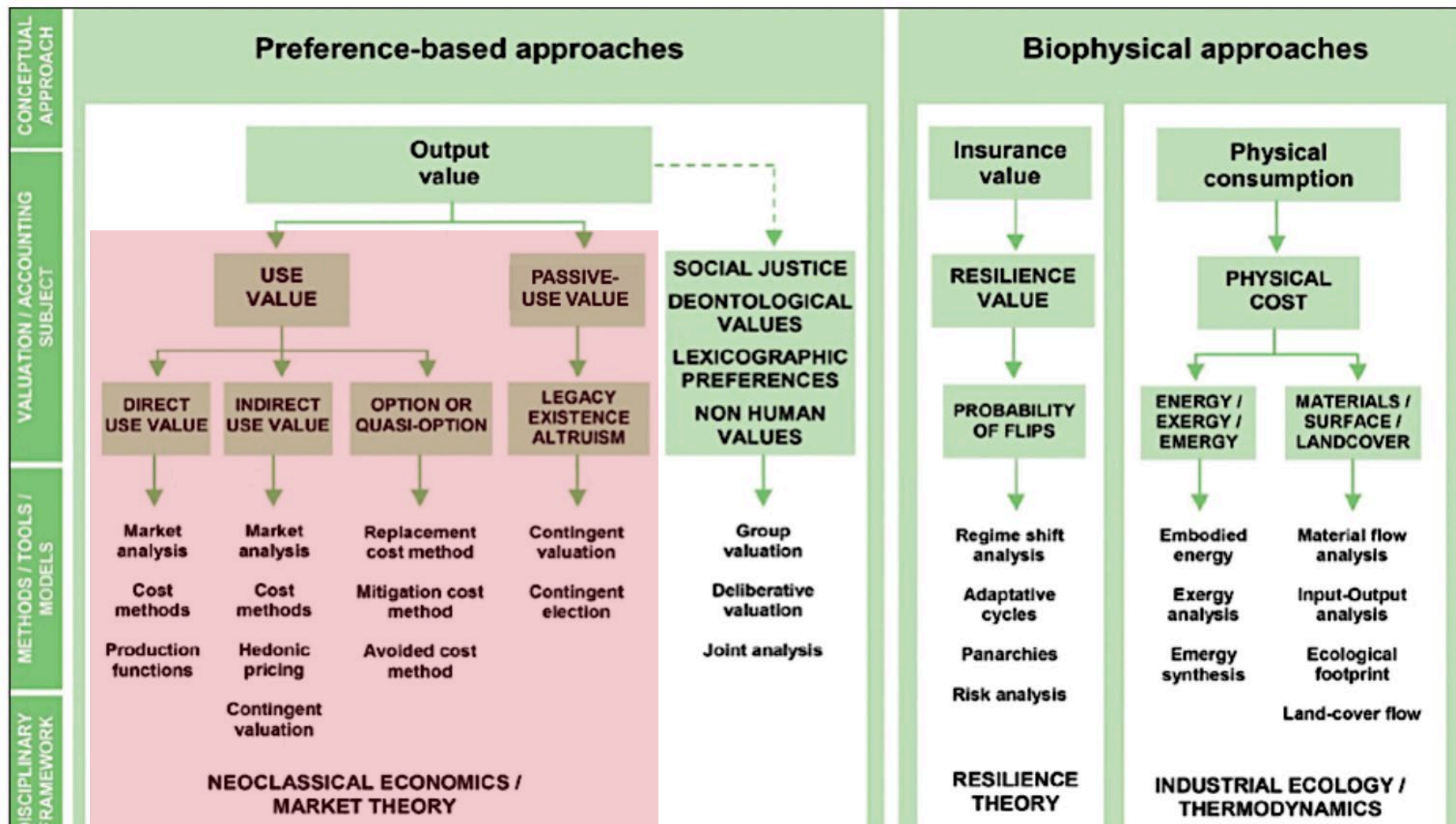
Financial analysis



Economic analysis



Preference-based and biophysical approaches to the valuation of ecosystem services



Source: modified from TEEB (2010) in: M.Masiero, M.Boscolo, S.K.Barua, I.Animon, J.R. Matta, D.Pettenella, 2019. Valuing forest ecosystem services: a training manual for planners and project developers. Forestry Working Paper No. 11. Rome, FAO. 216 pp.

Economic analysis of plantations?

Evidence about social benefits (externalities):

- **Employment:** all plantations for wood production with pines, eucalyptus, poplar, spruce, ...
- **Soil erosion protection:** plantations in steep mountain, costal dunes, areas exposed to avalanches, ...
- **Landscape and biodiversity:** cork oak plantations
- **Water regulation, flood prevention:** poplar plantations
- **NWFP (as public goods) co-production:** mushrooms from chestnut plantations
- **Tourism and recreation:**
- **C sequestration:** permanent plantations from conversion of farmland; C sequestered in wood products

No systematic data at micro-level, but the first steps in environmental accounting at macro scale: TEEB, MAES, ...

The European Framework for Integrated Environmental and Economic Accounting for Forests — IEEAF

Catalogue number of original printed publication: CA-27-99-241-EN-C

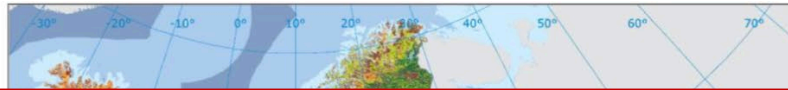


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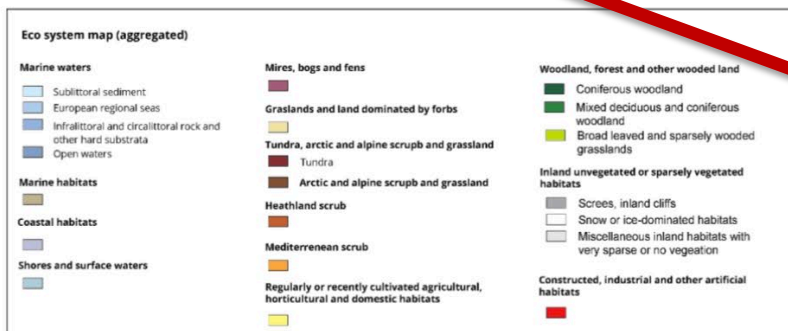
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<https://ec.europa.eu/eurostat/documents/39314/44178/Handbook-IEEAF-2002.pdf/c7b2aeaa-c4dd-49ce-bf25-05740d90e043>

MAES (Mapping ES in Europe): forest typologies (without plantations)



Ecosystem type	EUNIS Level 1	EUNIS Level 2	Total ecosystem coverage	
			Area (km²)	% area EUNIS level 2 per level 1
Woodland and forest	G Woodland, forest and other wooded land	E7 sparsely wooded grasslands	32195	4.64
		G1 Broadleaved deciduous woodland	487970	28.29
		G2 Broadleaved evergreen woodland	49248	2.86
		G3 Coniferous woodland	695907	40.35
		G4 Mixed woodland	291687	16.91
		G5 Lines of trees, small woodlands, recently felled woodlands, early stage woodland, coppice	199784	11.58
Grassland	E Grasslands and land dominated by forbs, mosses or lichens	E2 Moist grasslands	102151	46.08
		E3 Seasonally wet and wet grasslands	94150	42.47
		E4 alpine and subalpine grasslands	6453	2.91
		E5 Woodland fringes, clearings and tall forbs stands	16100	7.26
		E6 Inland salt steppes	278	0.82
			99	0.45
Woodland and forest	G Woodland, forest and other wooded land		1243168	99.18
			10292	0.82
			9330	1.35
			571931	46.08
			55771	8.2
			21128	3.05
Heathland and shrub	F Heathland, scrub and tundra	F1 Tundra	0	0.00
		F2 Arctic, alpine and subalpine scrub	34524	14.88
		F3 Temperate and mediterraneo-montane scrub	52824	22.76
		F4 Temperate shrub heathland	691	0.30



Eurostat

(Source: EEA)

- Some basic concepts
- **Plantation outcomes: increase or decrease of the set of ES?**
- Open questions

Plantations = specialization and reduction in the set of ES offered? (segregative model)

First observation

In Europe plantations typologies are growing as a consequence of a **broadening of products**:

not only timber plantations, but different types of biomass plantations (Short Rotation Coppices, Medium Rotation Forests, ...) and plantations for the production of NWFP: truffles, chestnuts, sap, resin, pine kernels, tannin, ...

→ At **large scale** a much **richer set of ES offered**

Plantations for birch sap extraction



Credits: http://newtastes.blogspot.com/2015/02/introducing-birch-syrup_19.html



a) Realization of the hole



b) Introduction into the holes the transparent hoses

Credits: C.M.Enescu (2017) Collection and use of birch sap, a less known non-wood forest product in Romania Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 17

Ash (*Fraxinus ornus*) plantation for the production of *manna*



Credits: <https://www.ilfrassino.it/frassino.php>



Credits: <https://lorenzovinci.it/>

Plantations = specialization?

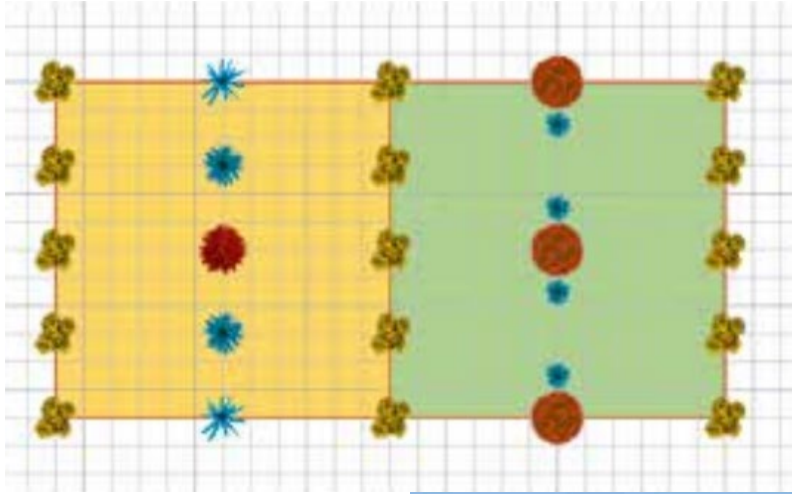
Second observation

Typologies of plantations are growing also as a result of **managers' motivations**: less climate and market vulnerability (**risk diversification**):

- Plantations with more clones and provenances
- Multi-species and multi-rotation plantations (2-4 species with 2-3 rotation period in the same stand)
- Agro-forestry model (plantations + crops)

→ a much richer set of ES offered also at micro scale

Multi-species and multi-rotation plantations



Credits: E. Buresti, P.Mori, F.Pelleri
(2017) Cenni di progettazione e linee
guida per il collaudo delle piantagioni
policicliche



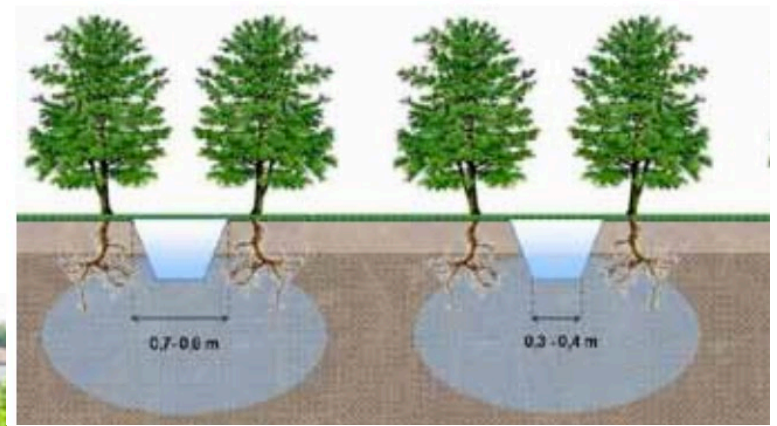
Plantations = specialization?

Third observation

Market-based mechanisms (like PES) are inducing a process of “**commoditization**” of some services → motivations to invest in plantations (as well as in management of semi-natural forests) for the offer of non-provisioning ES:

- Carbon forests
- Plantations for water cycle regulation (water infiltration for stabilizing the water table)
- Recreational forest plantations (new peri-urban forests)
- ...

Water infiltration plantations



Credits: Regione del Veneto, Aree forestali di infiltrazione per la ricarica delle falde idriche <http://www.ideassonline.org/public/pdf/BrochureAFI-IT.pdf>

Plantations = specialization?

Fourth observation

The prevalence of one prevailing (provisioning) service does not mean that other services are not delivered as well, under the pressure of **external drivers**:

- Certification (FSC and PEFC standards)
- Requests by financial institutions (Responsible financial funds, companies with CSR commitments, sponsors, ...)
- Stricter regulations (water-related, use of chemicals, nature protection, ...)

→ a much richer set of ES offered also at micro scale

- Some basic concepts
- Plantation outcomes: increase or decrease of the set of ES?
- **Open questions**

Questions open

- **No data → poor governance.**

If we have no systematic data on value generation by forests, how can we define the regime of public support (Forest Measures in RDP)?

- The context of plantations is becoming more diversified and complex: some **simplified interpretative models** (segregative vs. multi-purpose forestry) are **not adequate** conceptual tools
- The needs of **products for the bioeconomy** development and the ES **social demand** expansion are the drivers for **sustainable intensification** and the **diversification** of forest plantations

