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Plantations investments in southern Europe: a comparative analysis on returns, trends, and subsidy policies

Alex Pra, Lucio Brotto, Mauro Masiero, Davide Pettenella

Department of Land Environment Agriculture and Forestry
University of Padova

TESAF Dipartimento Territorio e Sistemi Agro-Forestali

Outline of the presentation

1. Introduction
2. Materials and methods
3. Preliminary results
4. Final remarks and next research steps

Slides available on the web. Search for "Pettenella"

1. Introduction
2. Materials and methods
3. Preliminary results
4. Final remarks and next research steps

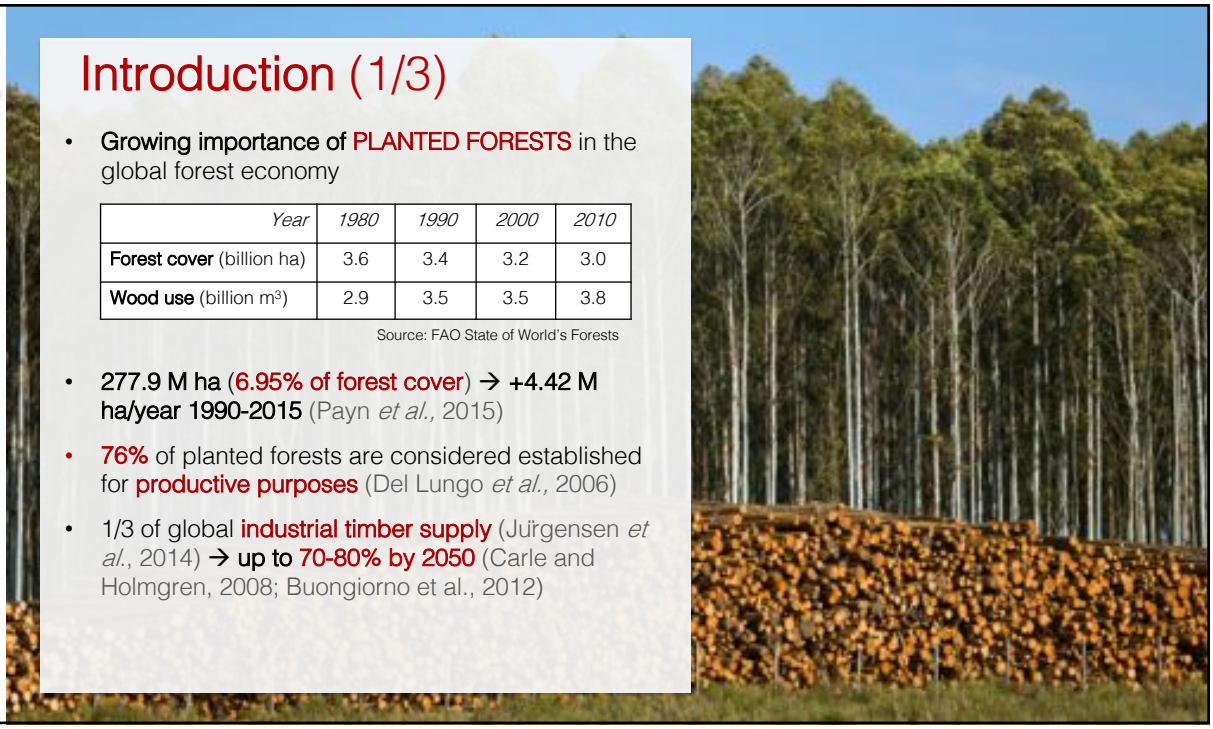
Introduction (1/3)

- Growing importance of PLANTED FORESTS in the global forest economy

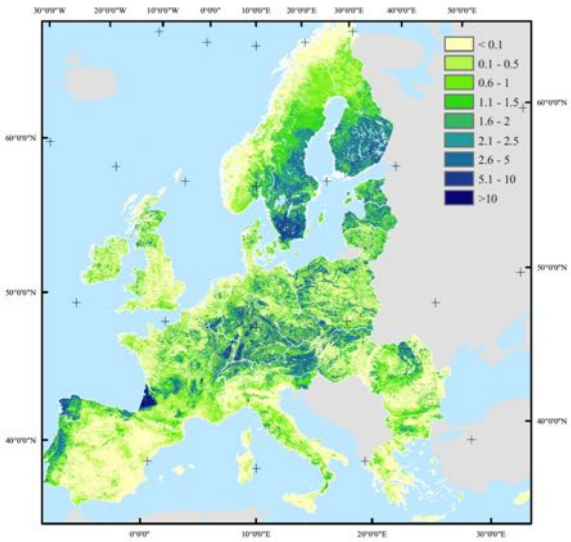
Year	*1980*	*1990*	*2000*	*2010*
Forest cover (billion ha)	3.6	3.4	3.2	3.0
Wood use (billion m^3)	2.9	3.5	3.5	3.8

Source: FAO State of World's Forests

- 277.9 M ha (6.95% of forest cover) → +4.42 M ha/year 1990-2015 (Payn *et al.*, 2015)
- 76% of planted forests are considered established for productive purposes (Del Lungo *et al.*, 2006)
- 1/3 of global industrial timber supply (Jürgensen *et al.*, 2014) → up to 70-80% by 2050 (Carle and Holmgren, 2008; Buongiorno et al., 2012)



Introduction (2/3)

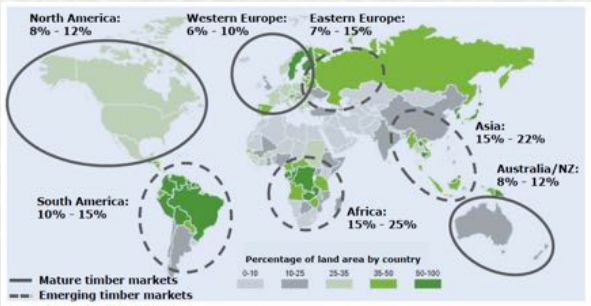


Map showing predicted wood production [unit: m^3 ha^1 land yr^1] in Europe over the period 2000–2010 (source: **Verkerk *et al.* 2015**)

- In SOUTHERN EUROPE → plantations are consolidated segment of investments
  - **Portugal and Spain:** 75% of wood production from plantations (Martinez de Arano and Lasgourgues, 2014)
  - **Italy**: >50% of the industrial roundwood domestic supply from poplar plantations in the Po valley (Assopannelli, 2012)
- Semi-natural forests → =multifunctionality =declining utilization rates) → increasing demand of timber and biomass (bioeconomy and bioenergy policies)

Introduction (3/3)

- Financial returns main driver for INVESTING in productive plantations
- Studies for main species and regions at global level: i.e. Sedjo (1983); Sedjo (2001); Cubbage *et al.* (2007); Cubbage *et al. (*2014).



Source: FAO State of World's Forests 2007

Research Gaps and Objectives

- **Lack of scientific literature (LACK OF INFORMATION)** estimating and analysing investment returns from plantations in southern Europe → **comparative level**
  - When data and indicators have been collected, information → **rarely made publicly available** or **published in national/regional technical forestry magazines** (e.g. Peupliers de France, 2016; Aunos, 2002; Borelli and Facciotto, 1997; Ragazzoni, 1993).

OBJECTIVES

…to investigate **financial profitability of plantation forestry in southern Europe**, focusing on the **main productive forest plantation species**, by:

1) providing **estimations of potential investment returns;**
2) analyzing their **evolution in the last 10-15 years**
3) analyzing the role of the major **policy and market factors** in influencing it.

Materials and methods (1/5)

1) Identification of representative plantation models and management regimes

- Approach similar to the one used in Sedjo (1983); and Cubbage *et al.* (2007).
- Not *ad-hoc* analyses → range of situations
- Appropriate management conditions assumption

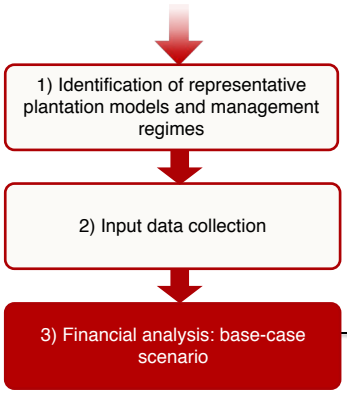
Materials and methods (2/5)

1) Identification of representative plantation models and management regimes

2) Input data collection

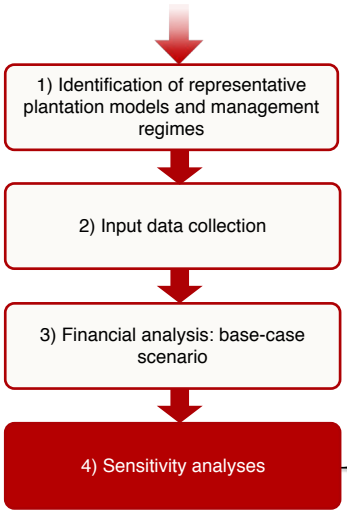
- Original + secondary data → databases, price lists, studies, buletins, auctions, + interviews with experts from forest owners' associations, industries and research institutes
  - Investment costs (site preparation, planting, silvicultural management, cleaning) + Agricultural Producer Price Indexes
  - Timber stumpage prices
  - Growth rates (or productiviness data, i.e. StandsSIM simulators for Portuguese plantations: http://www.isa.ulisboa.pt/cef/forchange/fctools/en/SimflorPlatform)
  - Inflation indexes
  - Other input data for sensitivity analyses

Materials and methods (3/5)



- **Capital budgeting criteria and techniques** (Zinkhan and Cubbage 2003, Bullard et al. 2011):
  - Net Present Value (**NPV**)
  - Land Expectation Value (**LEV**, or Faustmann formula)
  - Internal Rate of Return (**IRR**)
- Discounted **cash flow** → *r*=3.5% (HM Treasury, 2003) and alternatives (ECB, 2016; Snowdon and Harou, 2013; Cubbage et al., 2014)
- **Base case scenario:** no subsidies and land cost

Materials and methods (4/5)



- **Subsidies**
- **Land-use cost** (land rent)
- **Opportunity-cost** of alternative land use

Materials and methods (5/5)

1) Identification of representative plantation models and management regimes

2) Input data collection

3) Financial analysis: base-case scenario

4) Sensitivity analyses

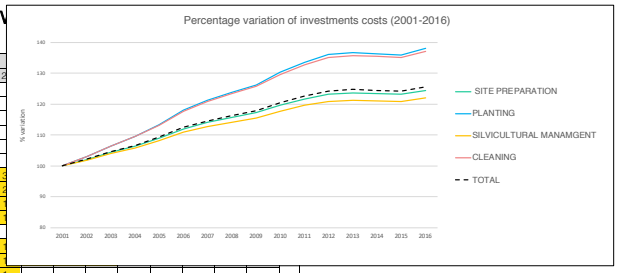
Hybrid poplar in northern Italy

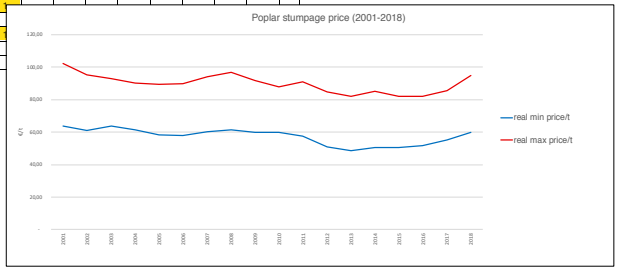
Hybrid poplar in northern Italy (1/5)

Silvicultural regime, investment costs and stumpage prices

Clone *Popolus x canadensis* 'I-214' → Ply

Operations			0	1	2
Costs	Site preparation	Ploughing	1		
		Ripping	1		
		Harrowing	1		
	Planting	Seedlings	1		
		Mark, dig and planting (278 trees/ha)	1		
		Localized irrigation	1		
	Silvicultural Management	Disk harrowing		3	
		Phitosanitary treatment *Marssonina brunnea*		2	
		Phitosanitary treatment *Saperda carcharias L*			
		Phitosanitary treatment *Cryptorhynchus lapathi*			
		Phitosanitary treatment *Phloeomyzus passerinii*			
		Weeding/cleaning		1	
		Fertilizer		1	
		Low pruning		1	
		High pruning			
		Irrigation		1	
	Cleaning	Stumps trituration and cleaning			
Revenues	Standing trees sale				





	Cmin (€/ha)	CMAX (€/ha)
Site preparation	252.5	353.5
Planting	1,554.4	2,021.0
Management	4,585.4	6,999.3
Cleaning	221.2	262.6
TOT	**6,614.5**	**9,636.4**

Hybrid poplar in northern Italy (2/5)

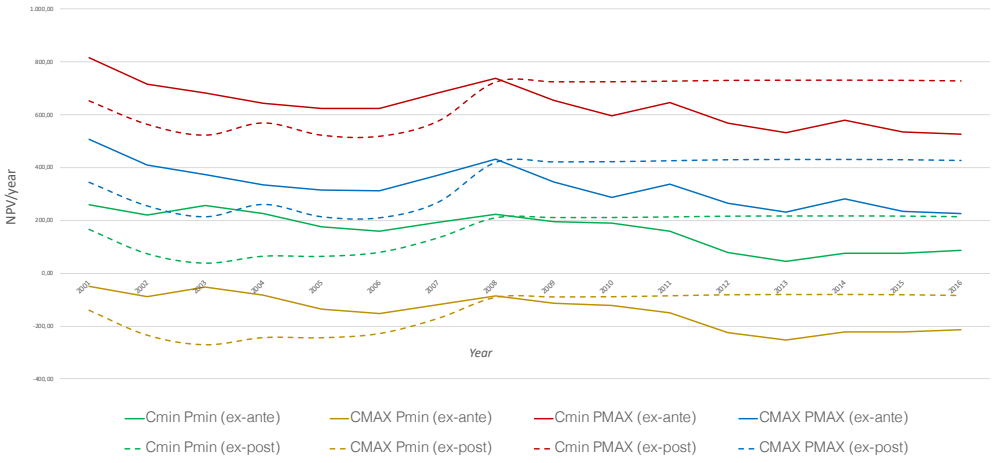
Base-case scenario, 2016

Models	*NPV (€/ha/year) r=3.5%*	*IRR*	*LEV (€/ha)*
Cmin Pmin	87.4	5.3%	2,496.2
CMAX Pmin	-213.4	n.d.	-6,096.6
Cmin PMAX	525.7	11.9%	15,020.7
CMAX PMAX	225.0	6.5%	6,627.8

Hybrid poplar in northern Italy (3/5)

Trend *ex-ante* and *ex-post*, 2001-2016 (real values)

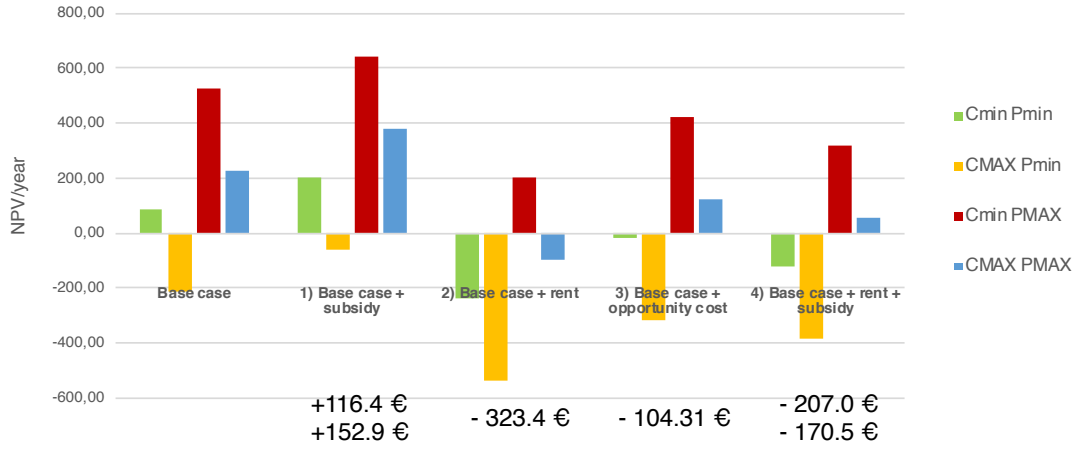
NPV/ha/year, *r*=3.5%



Hybrid poplar in northern Italy (4/5)

Sensitivity analyses, 2016

NPV/ha/year, *r*=3.5%



+116.4 €
+152.9 €

- 323.4 €

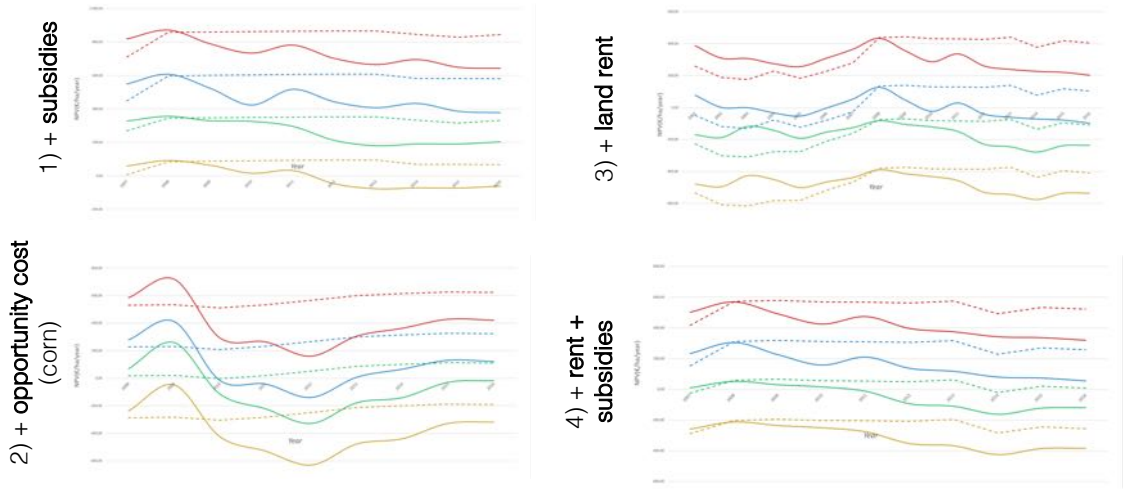
- 104.31 €

- 207.0 €
- 170.5 €

Hybrid poplar in northern Italy (5/5)

Sensitivity analyses trends (real values)

NPV/ha/year, *r*=3.5%

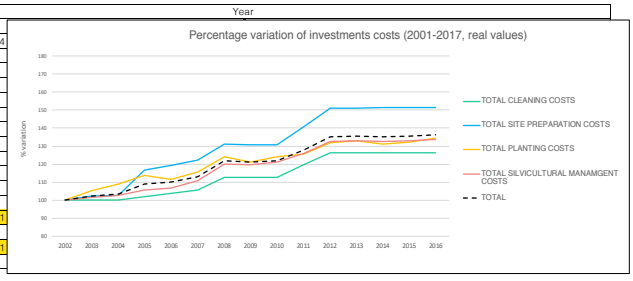


Eucalyptus globulus in Portugal

Eucalyptus globulus in Portugal (1/4)

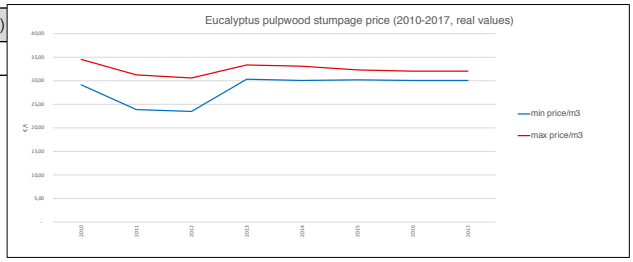
Silvicultural regime

Operations			Year 0	1	2	3	4
Costs	Cleaning	Stumps trituration and cleaning	1				
	Site preparation	Heaping and ridging	1				
		Harrowing	1				
		Ripping	1				
	Planting	Seedlings (1100 seedlings per ha)	1				
		Mark, dig and planting	1				
		Manual fertilization	1				
	Silvicultural Management	Beating up (15%)		1			
		Fertilization in lines		1			
		Weed control			1		
		Fertilization total				1	
		Weed control					1
		Thinning (1.6 shoots/stump)					
		General mainteinance costs		1	1	1	1
Revenues	Standing trees sale						



	€/ha
Cleaning	646.3
Site preparation	818.2
Planting	661.0
Management	1,763.9
TOT	3,889.4

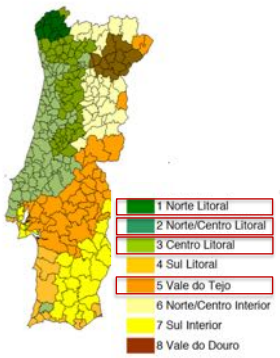
	Pmin (€/m3)
2017	30



Eucalyptus globulus in Portugal (2/4)

Productiveness input

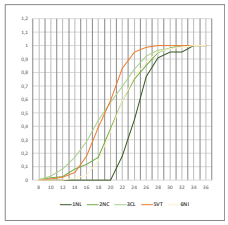
StandsSIM Portuguese forest simulator (**GLOBULUS growth and yield model**) developed by the University of Lisbon: **http://www.isa.ulisboa.pt/cef/forchange/fctools/en/SimflorPlatform)**



Climate var.

		Average altitude	Days of rain
Norte litoral	avg	149.6	113
Centro norte	min	350	87
	avg	449.5	102
	max	329.5	113
Centro litoral	min	50	63
	avg	264.2	90
	max	249.5	113
Valle Tejo	min	149.5	88
	avg	429.5	73
	max	234.5	63

Site index



Region	SI	Productivity pulpwood assortment (m3/ha)					
		Climate min		Climate avg		Climate max	
		m3 y12	m3 y24	m3 y12	m3 y24	m3 y12	m3 y24
Norte litoral	16			98,2	174		
				141,1	236,3		
				196,9	312		
				268,9	403,3		
				361,1	512,8		
Norte centro	14	67,9	125,10	69,70	130,10	73,40	136,60
	17	100,6	175,10	103,40	181,90	108,60	190,50
	20	143,5	236,30	147,70	245,50	154,90	256,50
	23	199,4	310,80	205,40	322,90	214,90	336,60
	24	221,4	339,00	228,20	352,10	238,60	366,90
Centro litoral	13	60,2	104,30	60,20	112,90	64,50	122,00
	16	85,6	148,20	90,60	160,10	96,90	172,50
	19	123,1	202,20	130,50	218,20	139,50	234,60
	22	171,9	267,90	182,50	288,90	194,90	310,00
	15	234,6	347,20	249,70	374,40	266,50	401,00
Valle Tejo	11	40,90	78,00	40,8	79,90	44,8	87,00
	14	64,10	116,10	64,1	118,10	70,1	128,00
	17	95,00	162,80	95,2	165,60	103,6	178,60
	20	135,4	220,1	136,1	214,10	147,4	240,6
	23	187,8	289,7	189,4	295,40	204,2	315,9

Eucalyptus globulus in Portugal (3/4)

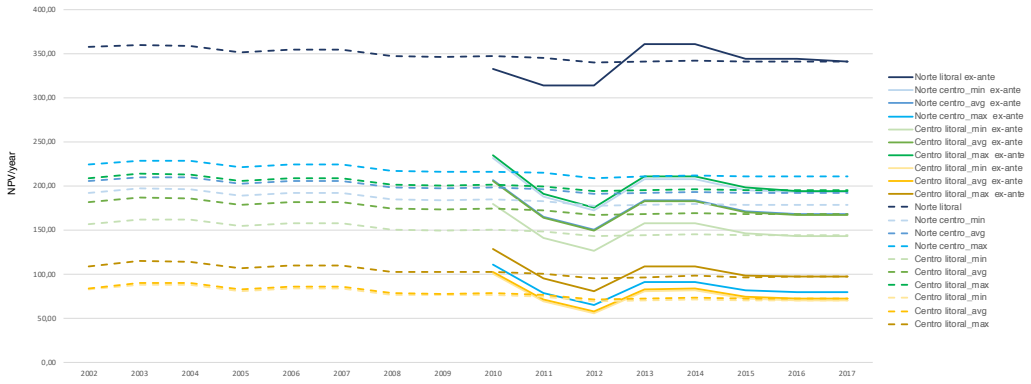
Base-case scenario, 2017

		NPV (€/ha/year) r=3.5%	IRR	LEV (€/ha)
Norte litoral	avg	305,5 – **341.7**	9.3% - **9.8%**	8,727.3 – 9,747.8
Centro norte	min	153,1 – 177.4	7.9% - 8.3%	4,373.0 – 5,069.5
	avg	165,6 – 190.8	8.1% - 8.6%	4,732.1 – 5,452.6
	max	183,0 – 209.4	8.4% - 8.9%	5,228.6 – 5,982.2
Centro litoral	min	120,6 – 142.9	7,1% - 7.6%	3,447.2 - 4,082.0
	avg	143,3 – 167.1	7,6% - 8.1%	4,095.2 – 4,773.3
	max	168,7 – 194.2	8,1% - 8.6%	4,821.1 – 5,547.5
Valle Tejo	min	**52,8** – 70.4	**6,7%** - 7.2%	1,507.9 – 2,011.2
	avg	54,4 – 72.1	6,7% - 7.2%	1,553.6 - 2,060.0
	max	77,4 – 96.6	7,3% - 7.8%	2,210.7 – 2,760.8

Eucalyptus globulus in Portugal (4/4)

Trend *ex-ante* and *ex-post*, 2002-2017 (real values)

NPV/ha/year, *r*=3.5%



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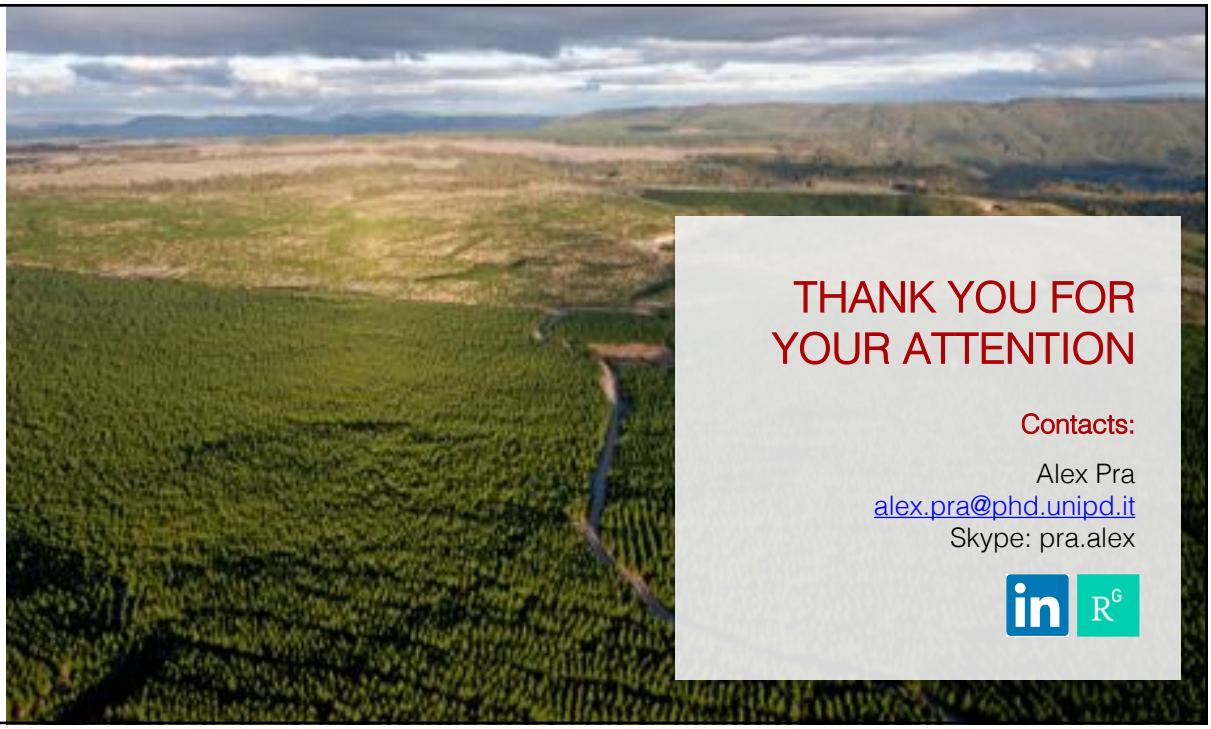
Final remarks and next research steps

- Estimations based on **assumptions** (silvicultural regime, management intensity,etc.) that **evidently cannot represent all the situations**
- We aim at estimating the **evolution** based on a range of situations → **basis for systematic monitoring** of plantation investments returns (e.g. observatory)
  - we need **Information**
  - Information → **strategic vision** for the sector
- Serve as a benchmark, that can support individuals, companies and new investors to make better investments decisions in this context
- Two elements to improve the research:
  - Include the **risk component** (market + natural) in the financial analysis → **risk indicator**
  - Include in the analysis **future predicion models** (of investments costs and timber prices evolution);



THANK YOU FOR YOUR ATTENTION

Contacts:

Alex Pra
alex.pra@phd.unipd.it
Skype: pra.alex