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DRIVERS OF SWISS AGROFORESTRY
$ IT'S NOT ALL ABOUT MONEY $

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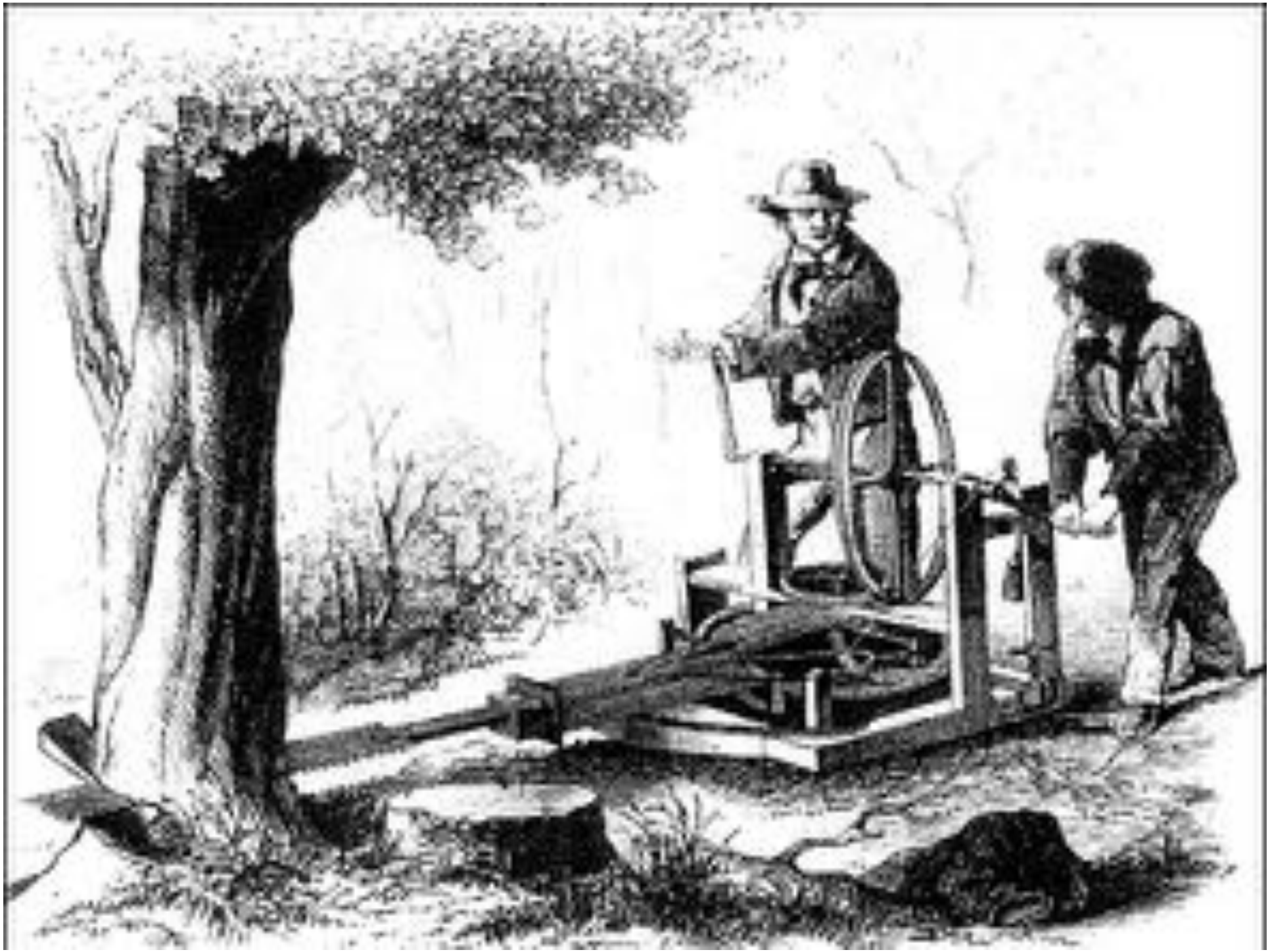
3 Chapters

- Sereke F, Dobricki M, Wilkes J, Kaeser A, Graves AR, Szerencsits E, Herzog F (2015a) **Swiss farmers don't adopt agroforestry because they fear for their reputation**. Agroforest Syst. doi:10.1007/s10457-015-9861-3

- Sereke F, Graves AR, Dux D, Palma JHN, Herzog F (2015b) **Innovative agroecosystem goods and services: key profitability drivers in Swiss agroforestry**. Agronomy for Sustainable Development. doi: 10.1007/s13593-014-0261-2

- Conclusions



Arisdorf BL: **1941** (Tanner, 2001)

Arisdorf BL: **1999** (Tanner, 2001)

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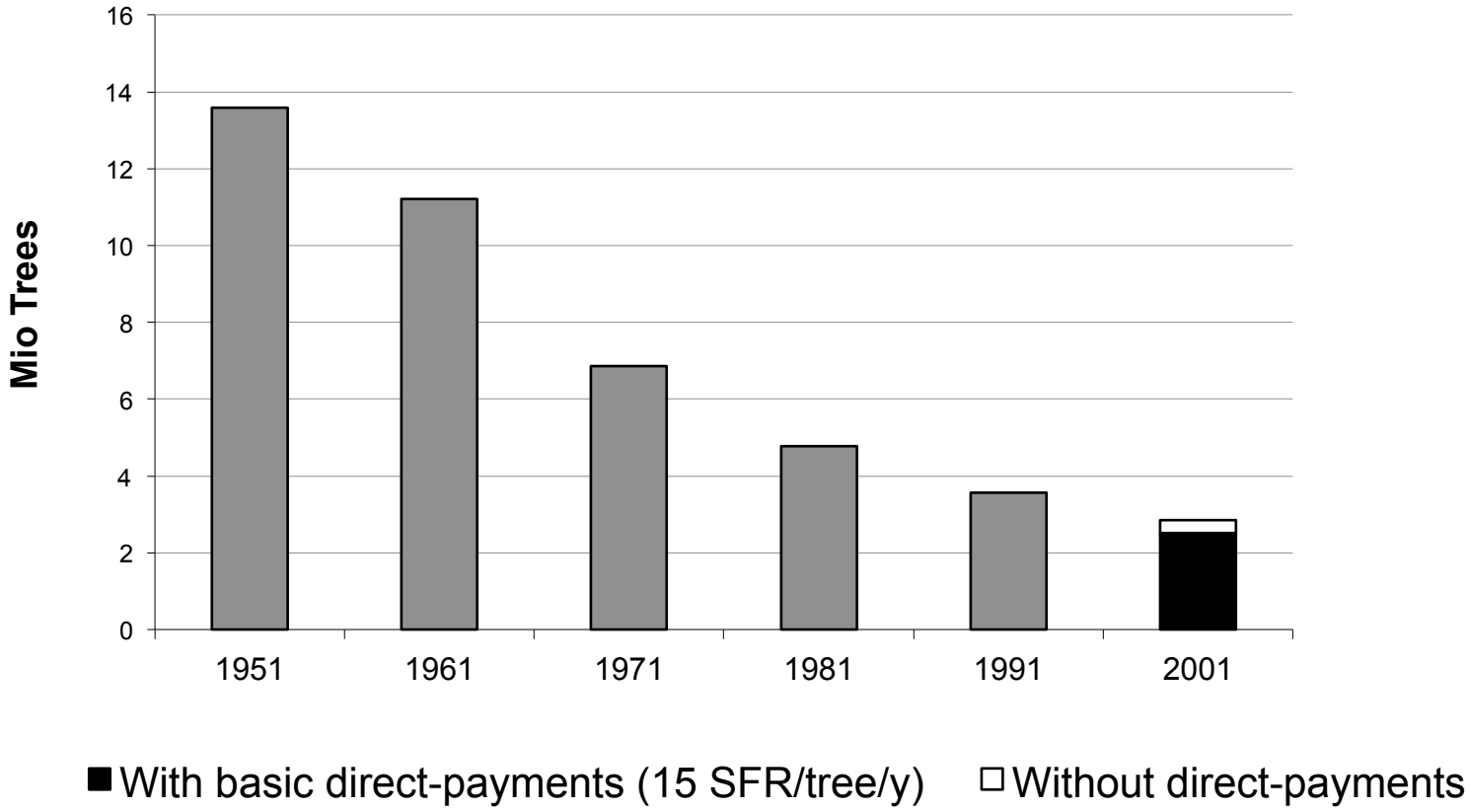
1951 – 2001: 80% decline of trees in Swiss agricultural landscapes



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Why is agroforestry, among Swiss farmers, not popular anymore?

…despite increasing payments for ecosystems services

Method

Seven-variables-survey (Sereke et al., 2015a)

"**Theory of planned behaviour**" (Ajzel 1991)
&
The concept of ecosystem services (McAdam, 2009, TEEB, 2010)
ES: Production, Habitat, Regulation & Culture

>>> Interviews with 50 randomly selected farmers were conducted, in the German and French speaking regions of Switzerland

Seven-variables-survey: driving forces of Farmers' behaviour

Land user

1) **Intention**
2) **Socio-economic characteristics**
3) **Attitudes**
4) **Perceived behavioral control**
5) **Ecosystem services**
6) **Economic motivations**
7) **Subjective norms**

> Behavior

- **Society**
  Consumers of ecosystem services
- **Policy**
  Define framework conditions
- **Research**
  Provide knowledge
- **Extension**
  Provide know-how
- **Environmental organizations**
  Demand nature conservation

1) **Intention**: adopters and non-adopters

- 26 adopters & 24 non-adopters (to maintain or adopt agroforestry)

➢ **What is motivating** adopters and what is **de-motivating** non-adopters to adopt agroforestry practices?

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2) **Socio-economic characteristics**: Business as usual

- Adopters & non-adopters **specialized in common monoculture** arable farming, fodder production or animal husbandry;
- **Trees played a minor role** in the farm businesses.

3) Pessimistic **Attitudes**: underestimation of productivity

Variable	Adopters		Non- adopters		All Farmers	
3) Attitudes	**M**	**SD**	**M**	**SD**	**M**	**SD**
Productivity and management						
Productivity	**3.0**	**0.7**	**2.0*** **	**0.7**	**2.5**	**1.0**
Riskiness	3.2	0.9	2.7	1.1	3.0	1.4
Intercrop competition	3.1	0.8	2.8	1.3	2.9	1.4
Mechanization	3.1	0.8	2.6	1.2	2.9	1.5

* p < .05, ** p < .01, *** p < .001

x, y < 4 = negative attribute

x, y ≥ 4 = positive attribute

- Scoring range: 6-point item from 1 (I totally disagree/very low) – 6 (I totally agree/very high)
- Mean scores and standard deviations across samples (n=50), adopters (n=26), non-adopters (n=24).
- Mean comparison: 2 sample T-test

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Land Equivalent Ratio (LER) higher in AF

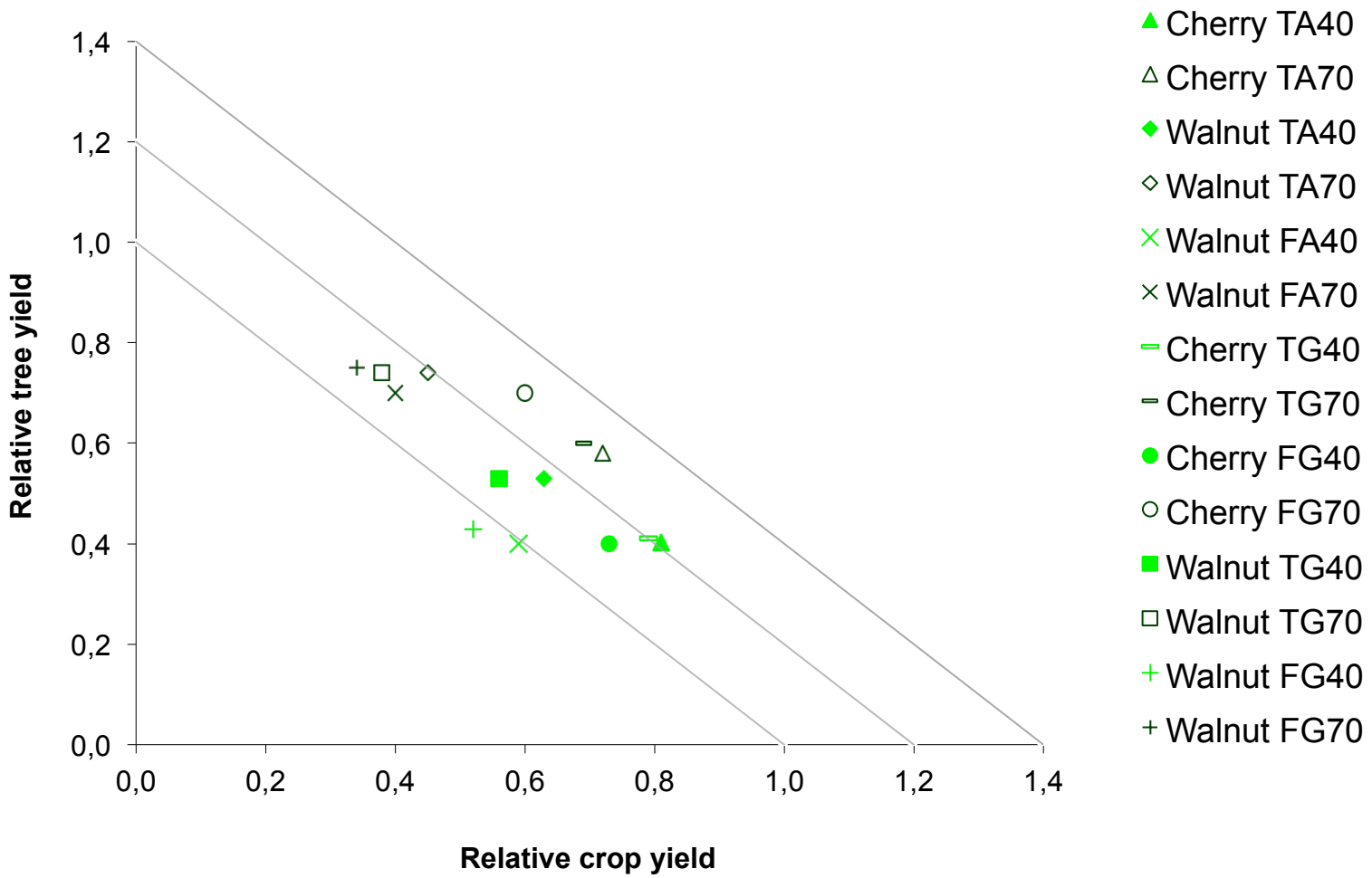
"the ratio of the area under sole cropping to the area under the agroforestry system, at the same level of management that gives an equal amount of yield" Ong (1996)

LER = 1

LER > 1

(Graves et al., 2007)

Productivity of Swiss agroforestry (LER)
(Sereke et al., 2015)



4) Low perceived behavioral control

Variable	Adopters		Non- adopters		All Farmers	
Perceived behavioral control	**M**	**SD**	**M**	**SD**	**M**	**SD**
Control over decisions	4.5	1.4	3.9	1.4	4.2	1.4
Confidence in framework conditions	3.6	1.3	2.9	1.4	3.3	1.4
Confidence to manage	**3.8**	**1.2**	**2.4*** **	**1.3**	**3.2**	**1.3**

* p < .05, ** p < .01, *** p < .001

x, y < 4 = negative attribute
x, y > 4 = positive attribute

5) Ecological motivations: habitat **ecosystem services**

Variable		Adopters		Non- adopters		All Farmers	
Ecosystem services		**M**	**SD**	**M**	**SD**	**M**	**SD**
Ecosystem services							
Production (subsistence)		4.5	1.2	3.9	1.5	4.2	1.4
Regulation	Soil	3.7	1.4	3.4	1.2	3.6	1.3
	Water	3.3	1.3	3.2	1.2	3.3	1.2
	Climate	3.1	1.5	3.0	1.3	3.1	1.4
Habitat	**Shelter**	**5.0**	**1.0**	**4.5**	**1.3**	**4.8**	**1.2**
	Biodiversity	**5.0**	**0.8**	**4.5**	**1.2**	**4.8**	**1.0**
Cultural landscape		**4.7**	**0.8**	**3.8****	**1.4**	**4.3**	**1.2**

* p < .05, ** p < .01, *** p < .001

Ecological motivations: habitat ecosystem services

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Ecological motivations: habitat ecosystem services

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Ecological motivations: habitat ecosystem services

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Ecological motivations: habitat ecosystem services

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Ecological motivations: habitat ecosystem services

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Ecological motivations: habitat ecosystem services

6) Economic de-motivations

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Variable	Adopters		Non- adopters		All Farmers	
Economic motivations	**M**	**SD**	**M**	**SD**	**M**	**SD**
Economic motivations						
Profitability of tree products	3.0	1.2	2.3*	1.3	2.6	1.3
Payments for ecosystem services	3.6	1.4	3.2	1.2	3.4	1.3

* p < .05, ** p < .01, *** p < .001

7) Subjective norms: reputational risks

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(i) Which stakeholder do you expect to approve the adoption of agroforestry? (ii) Would adoption have a positive effect on your reputation?

Variable	**Adopters**		**Non- adopters**		**All Farmers**	
Subjective norms	M	SD	M	SD	M	SD
Agroforestry would be approved by:						
Fellow farmers	**3.0**	**1.0**	**2.3***	**0.9**	**2.7**	**1.0**
Extension officers	3.8	0.8	3.1*	1.0	3.5	1.0
Scientists	4.2	1.0	3.5*	1.0	3.9	1.1
Agricultural policymakers	4.7	1.0	4.3	1.1	4.5	1.1
Swiss public	**4.9**	**0.8**	**4.9**	**0.7**	**4.9**	**0.8**
Environmentalists	5.6	0.7	5.6	0.8	5.6	0.8
Effect on reputation	**4.4**	**1.1**	**3.5****	**1.2**	**3.9**	**1.2**

* $p < .05$, ** $p < .01$, *** $p < .001$

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Conclusions

The seven-variables-survey identified **3 complex of non-monetary obstacles**, which partly explain why payments for ecosystem services have not been more successful to change farmers' behavior.

Conclusion

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Non-monetary challenge I:

How to overcome the social resistance against payments for ecosystem services?

- Beside payments for ecosystem services, the recovery of **marketing opportunities** for fruits seems to be the more sustainable way to encourage farmers to plant trees.

Conclusion

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Non-monetary challenge II:

How to address pessimistic attitudes & low perceived behavioral control?

There is need for:

- **Transdisciplinary co-production of agroecological knowledge & technologies,** e.g.: farmer field schools, field experiments;
- a wide range of **disciplinary and transdisciplinary research** to co-develop agroforestry systems.

Conclusion

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Non-monetary challenge III:

How to increase the reputation of agroforestry practices among mainstream farmers?

There is need for

- transdisciplinary collaboration to **co-produce shared visions** towards sustainability; e.g. through multi-stakeholder platforms;
- **participation of farmers in agricultural R&D** to avoid social resistance.

RISE software
(Response Inducing Sustainability Evaluation)

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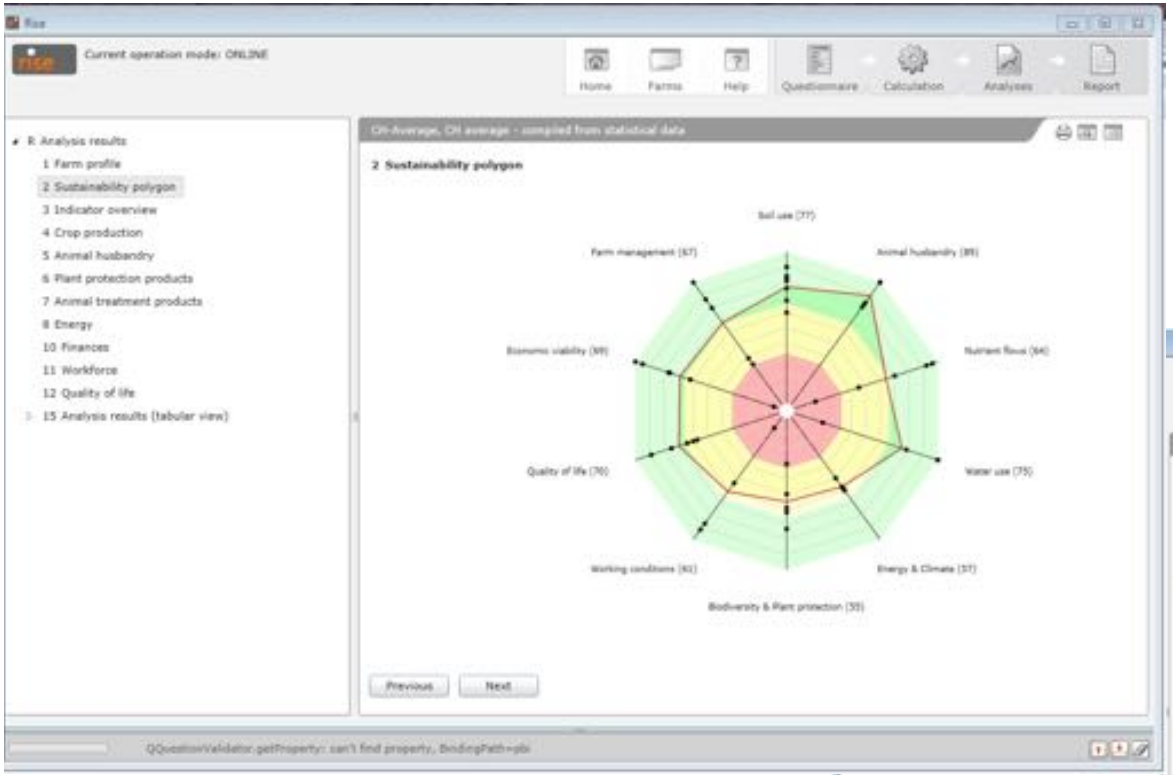
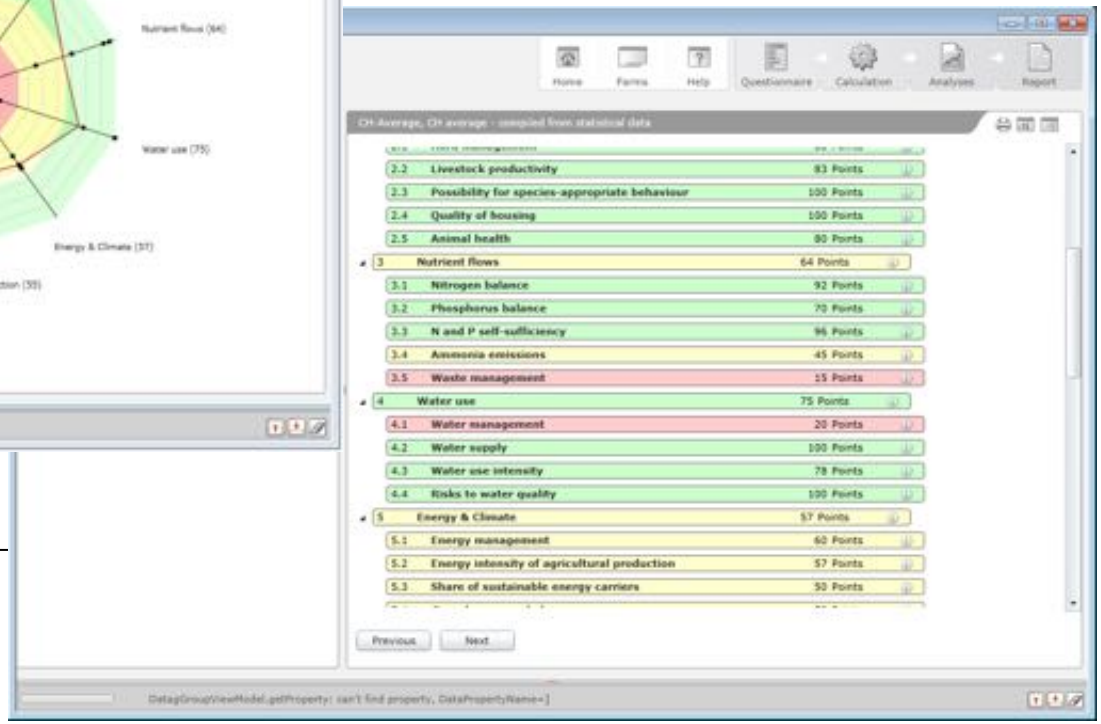
Can be used online or offline. Currently available in 9 languages.

Create a free guest account at www.farmrise.ch !





Outlook

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There is a critical need for **collective action**. To halt the ongoing decline of trees & to **support farmer innovations, towards restoring multifunctional agro-ecosystems.**

- ✓Today, participatory agroforestry research is conducted both in Switzerland (www.agroforst.ch) and internationally (www.agforward.eu).
- ✓the gradual improvement of the direct-payment system;
- ✓this is encouraging for farmers to develop productive and multifunctional agricultural landscapes.

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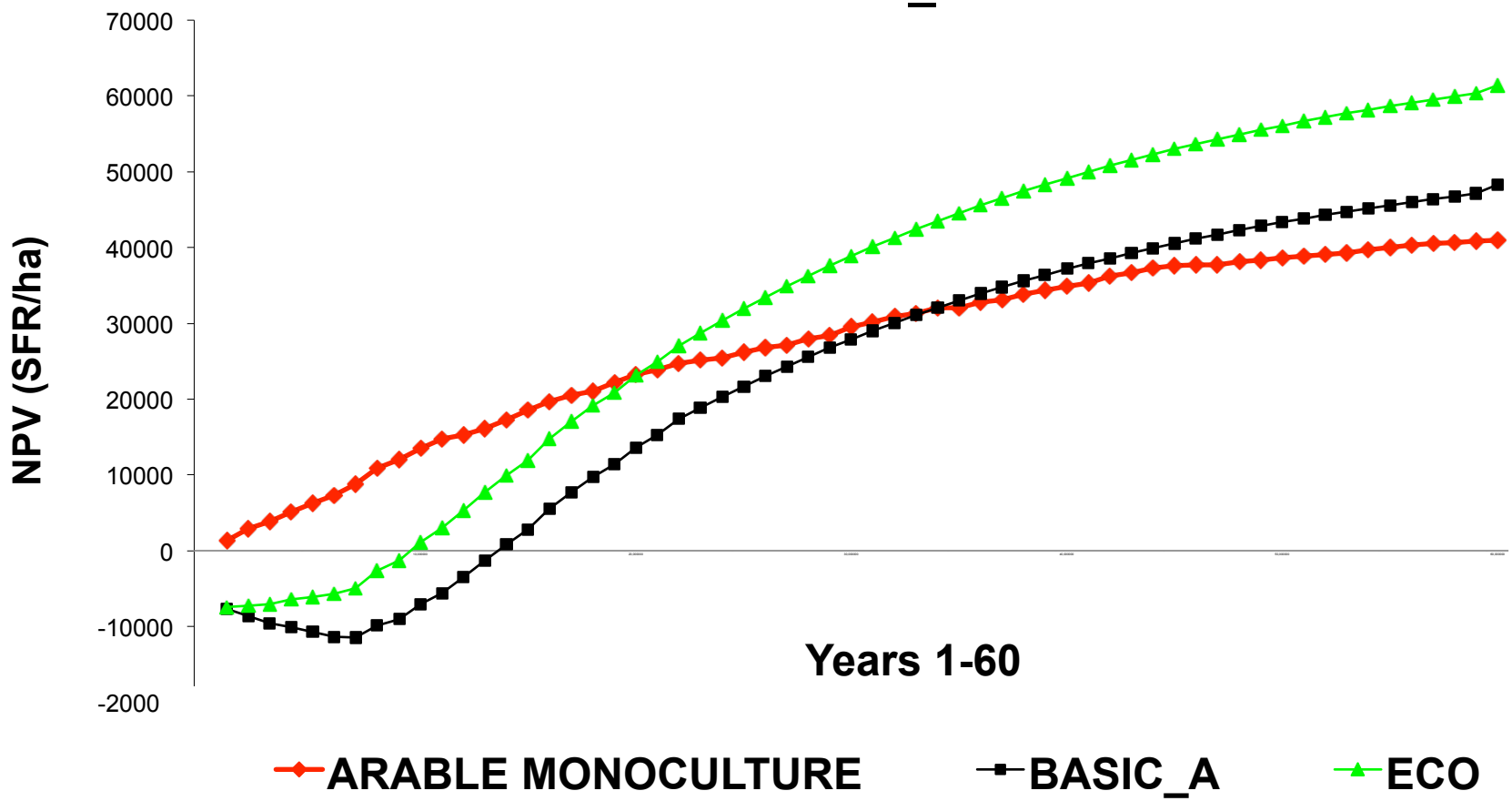
Thanks for your attention!

Chapter II: Profitability of Swiss agroforestry

Example: Silvoarable walnut system, 70 trees/ha
Scenarios: BASIC_A and ECO



1) Intention: adopters and non-adopters

Adopters

"My first thought was: are they crazy? How can this be compatible with today's mechanization" (F13, Dachsen)

Non-adopters

"Yes agroforestry is an interesting option. The youth need opportunities for the future" (F7, Liestal, BL)

Objective

To explore:

1. Bio-economic barriers and opportunities

1.1 Which AF practices are feasible today?

1.2 Are they productive and profitable compared to monoculture?

2. Social barriers and opportunities

What are the key drivers of farmers' behaviour?

1.1) Which AF practices are feasible today?

Exploratory survey on farmer innovations (Overall output: Classification of features and functions of Swiss AF practices)

Silvopastoral practices

Kastanien Selven:
Tessin
(Chestnut & Livestock combinations)

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Silvopastoral practices

Hochstamm Aprikosen, Valais

Silvoarable agroforestry: Mostobst & Ackerbau (Sursee)

1.2) Bio-economic assessment

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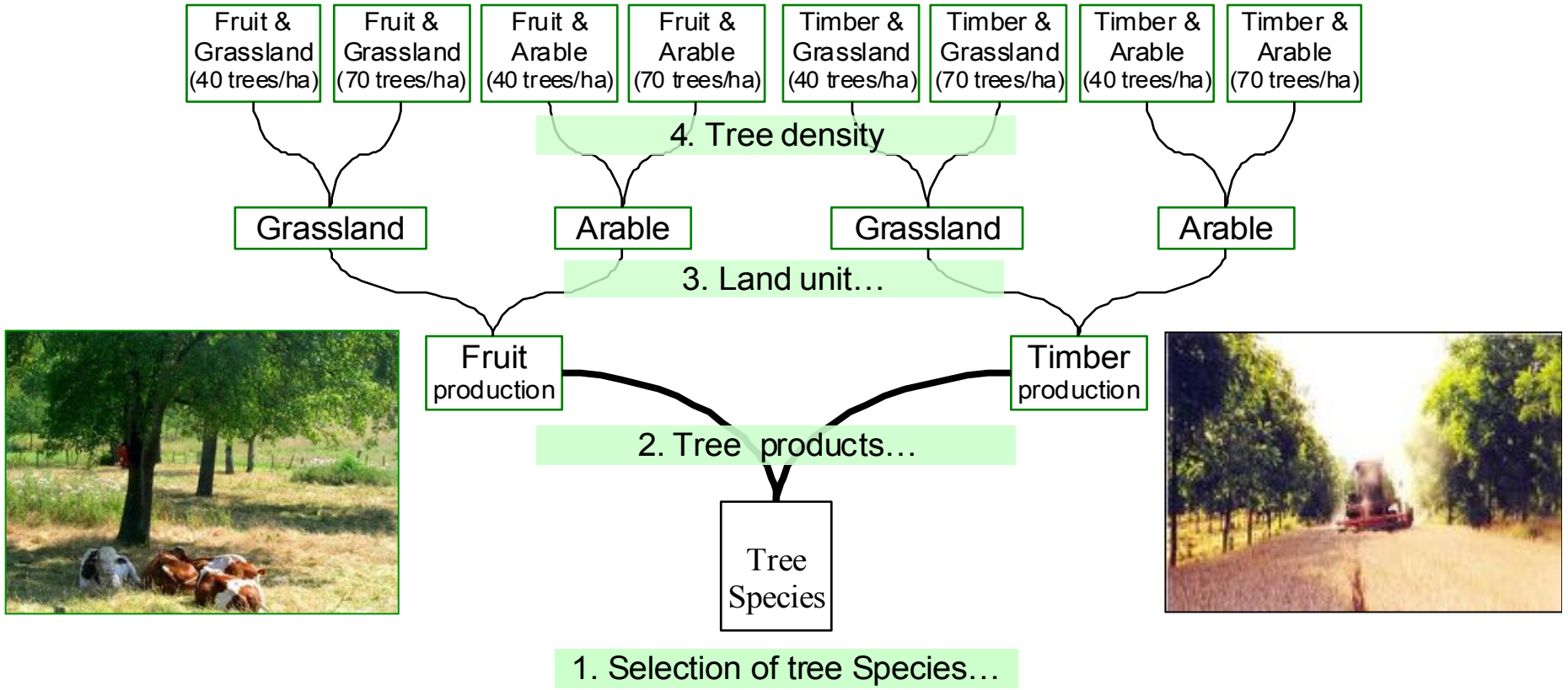
Are Swiss AF practices productive and profitable compared to monoculture?

a) Simulation of yields and productivity using the bio-physical "Yield-SAFE" model (van der Werf et al., 2007)
b) Estimation of profitability with the bio-economic "Farm-SAFE" model (Graves et al., 2007)

2) Bio-economic assessment: a) define AF practices



Tree species: Walnut (*Juglans hybr.*) and wild cherry (*Prunus avium*)

2) Bio-economic assessment: c) Profitability
Grant and price Scenarios

a) **BASIC_A: Baseline scenario**, with basic grants (15 SFR/tree^{-1}) and average tree product prices;

b) **BASIC_P**: Basic grants and pessimist tree product price (-10%);

c) **BASIC_O**: Basic grants and optimist tree product price (+10%), representing the tree product innovation strategy;

- Product innovation strategy

d) **ECO**: ecosystem services scenario with ecological grants (45 SFR/tree^{-1}) and average tree product price

- Ecological innovation strategy

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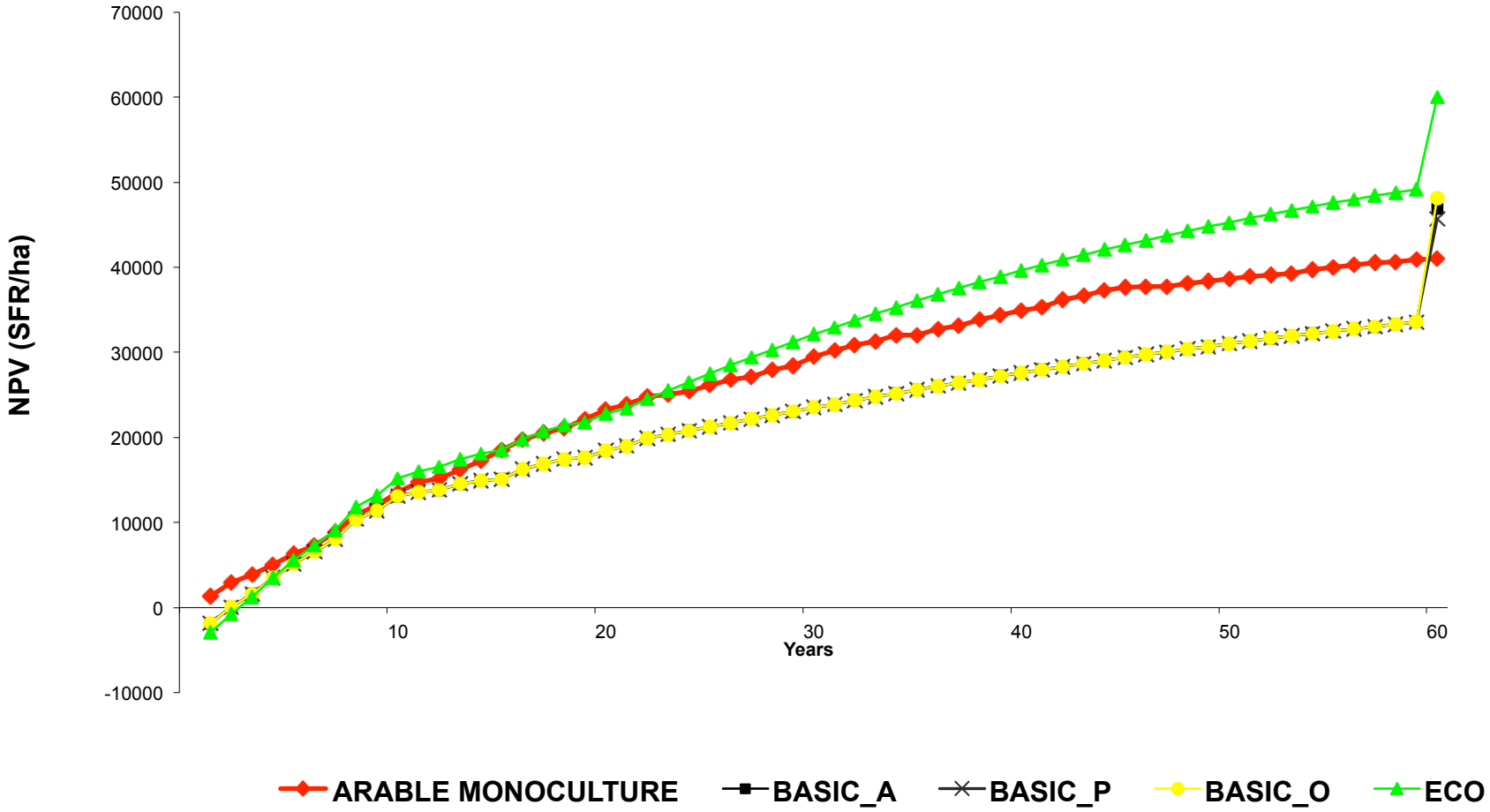
Net present value of the 4 scenarios:

a) baseline (BASIC_A); b) pessimist (BASIC_P); c) optimist or product innovation (BASIC_O) and c) ecosystem services (ECO) (SFR/ha-1, 3.5% discount rate)

Agroforestry practices	a) BASIC_A			b) BASIC_P			c) BASIC_O			d) ECO		
Timber (T)/ Fruits (F)	SFR/ha in year			SFR/ha in year			SFR/ha in year			SFR/ha in year		
Arable (A)/ Grassland (G)	10	30	60	10	30	60	10	30	60	10	30	60
Arable monoculture	13'533	29'510	41'008	13'533	29'510	41'008	13'533	29'510	41'008	13'533	29'510	41'008
Wild cherry (TA40)	10'182	24'579	35'763	10'182	24'579	35'212	10'182	24'579	36'315	**14'128**	**33'827**	**47'258**
Wild cherry (TA70)	11'001	27'328	40'019	11'001	27'328	39'207	11'001	27'328	40'831	**13'805**	**35'261**	**51'411**
Walnut (TA40)	11'352	21'298	38'751	11'352	21'298	37'863	11'352	21'298	39'638	**15'581**	**30'467**	**48'465**
Walnut (TA70)	13'113	23'487	**46'920**	13'112	23'487	**45'683**	13'112	23'487	**48'156**	**15'183**	**32'091**	**60'020**
Walnut (FA40)	-1'661	23'442	38'049	-2'214	17'820	28'990	-1'246	27'658	**44'844**	5'027	**32'491**	**48'265**
Walnut (FA70)	-7'089	27'909	**48'280**	-7'969	18'965	33'867	-6'429	**34'616**	**59'089**	1'136	**38'847**	**61'360**
Grassland monoculture	10'542	23'554	32'469	10'542	23'554	32'469	10'542	23'554	32'469	10'542	23'554	32'469
Wild cherry (TG40)	7'903	23'106	**36'629**	7'903	23'106	**35'212**	7'903	23'106	**37'196**	**12'095**	**32'333**	**47'285**
Wild cherry (TG70)	8'642	**26'618**	**43'435**	8'642	**26'618**	**42'599**	8'642	**26'618**	**44'271**	9'815	**30'251**	**50'095**
Walnut (TG40)	8'051	11'561	26'264	8'051	11'561	25'376	8'051	11'561	27'152	**12'574**	22'598	**40'513**
Walnut (TG70)	8'978	17'271	**40'525**	8'978	17'271	**39'289**	8'978	17'271	**41'761**	6'679	**25'652**	**51'596**
Wild cherry (FG40)	-5'426	16'893	**33'973**	-5'526	14'602	29'603	-5'338	18'914	**37'829**	1'880	**27'842**	**45'371**
Wild cherry (FG70)	-12'383	16'678	**40'539**	-12'542	13'033	**33'586**	-12'242	19'894	**46'674**	-4'468	**26'643**	**49'867**
Walnut (FG40)	-4'439	16'322	29'361	-4'992	10'701	20'302	-4'024	20'539	**36'155**	2'361	**26'029**	**41'141**
Walnut (FG70)	-10'826	20'941	**41'158**	-11'706	11'997	26'746	-10'166	**27'648**	**51'968**	-3'698	**31'452**	**53'131**

Silvoarable Walnut/Timber 70 trees/ha
Scenarios: BASIC_A, BASIC_P, BASIC_O and ECO

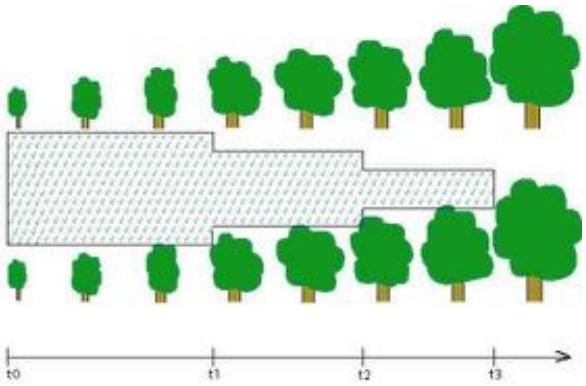


Silvoarable AF

Poplar shade: (C. Dupraz, Venezobres, France)

http://www.montpellier.inra.fr/safe/

Silvopastoral AF



Windbreaks

Tree Allée

Baumreihen- und Alleenkampagne: http://www.pronatura.ch/lu

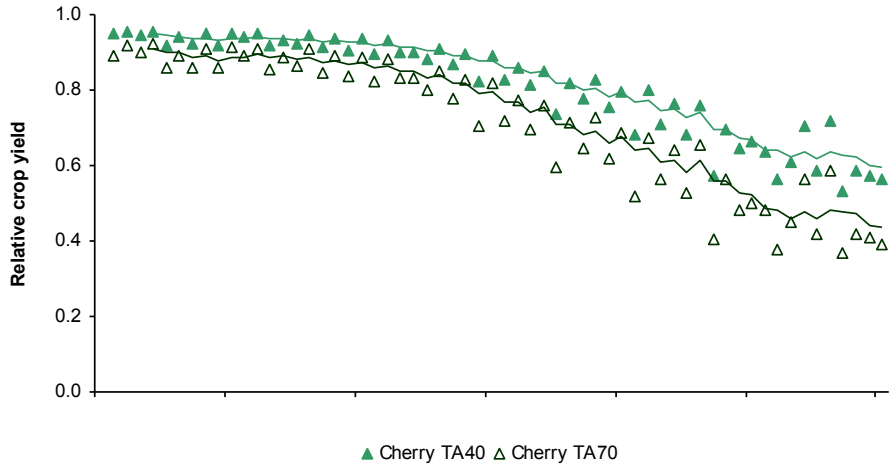
2) Bio-economic assessment : b) productivity

Relative crop yields (AF/monoculture)

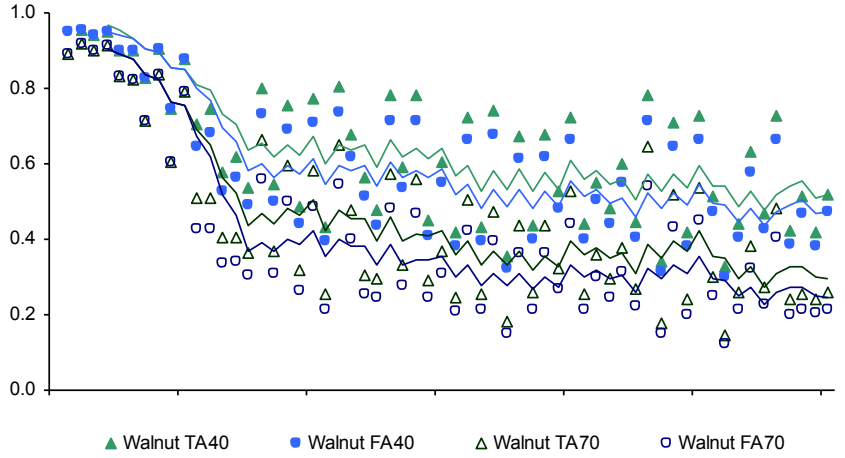
under wild cherry and walnut trees with the tree-crop combinations: timber-arable (TA), fruit-arable (FA), timber-grassland (TG) and fruit-grassland (FG) with 40/70 trees/ha)

Konkurrenz
- Baumnuss > Vogelkirsche
- Früchte > Edelholz
- 70 > 40 Bäume/ha

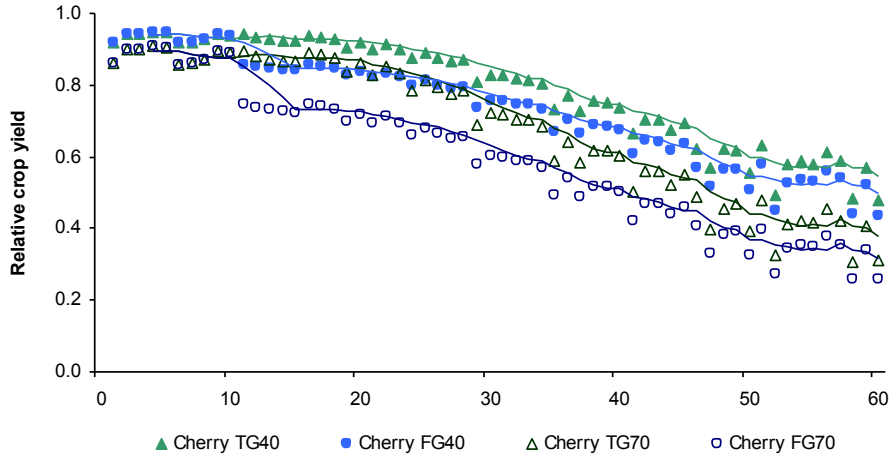
a) Wild Cherry silvoarable agroforestry



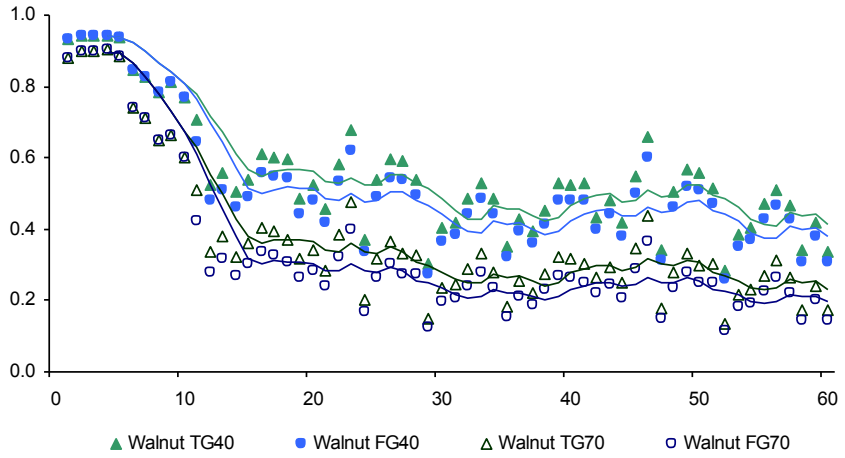
b) Walnut silvoarable agroforestry



c) Wild Cherry silvopastoral agroforestry



d) Walnut silvopastoral agroforestry



Konkurrenz auf die Unterkultur
- Baumnuss > Vogelkirsche
- Früchte > Edelholz
- 70 > 40 Bäume/ha

2) Bio-economic assessment : Productivity

Fallbeispiel: 40 Vogelkirsche/ha Wertholzproduktion (50% W-Weizen, 25% W-Raps, 25% Kunstwiese)