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


- Conclusions
Arisdorf BL: 1941 (Tanner, 2001)
Arisdorf BL: 1999 (Tanner, 2001)
1951 - 2001: 80% decline of trees in Swiss agricultural landscapes

- With basic direct-payments (15 SFR/tree/y)
- Without direct-payments
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?
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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adopters</th>
<th></th>
<th>Non- adopters</th>
<th></th>
<th>All Farmers</th>
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<tbody>
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<td><strong>Productivity and management</strong></td>
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<td><strong>2.0</strong>***</td>
<td><strong>0.7</strong></td>
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<td>1.5</td>
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</table>

* 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
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

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<td>SD</td>
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<td>Control over decisions</td>
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<td>1.4</td>
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<td>1.3</td>
<td>2.9</td>
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<td>3.3</td>
<td>1.4</td>
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<tr>
<td>Confidence to manage</td>
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<td>1.2</td>
<td><strong>2.4</strong>*</td>
<td><strong>1.3</strong>*</td>
<td><strong>3.2</strong>*</td>
<td><strong>1.3</strong>*</td>
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5) Ecological motivations: habitat ecosystem services

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<td><strong>Ecosystem services</strong></td>
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<td>Production (subsistence)</td>
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<td>3.2 1.2</td>
<td>3.3 1.2</td>
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<tr>
<td>Climate</td>
<td>3.1 1.5</td>
<td>3.0 1.3</td>
<td>3.1 1.4</td>
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<tr>
<td><strong>Habitat</strong></td>
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<tr>
<td>Shelter</td>
<td>5.0 1.0</td>
<td>4.5 1.3</td>
<td>4.8 1.2</td>
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<tr>
<td>Biodiversity</td>
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<td>4.5 1.2</td>
<td>4.8 1.0</td>
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<tr>
<td>Cultural landscape</td>
<td>4.7 0.8</td>
<td>3.8** 1.4</td>
<td>4.3 1.2</td>
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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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<th>Adopters</th>
<th>Non-adopters</th>
<th>All Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic motivations</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Profitability of tree products</td>
<td>3.0</td>
<td>1.2</td>
<td>2.3*</td>
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<tr>
<td>Payments for ecosystem services</td>
<td>3.6</td>
<td>1.4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

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7) Subjective norms: reputational risks

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

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</tr>
</thead>
<tbody>
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<td>M  SD</td>
<td>M  SD</td>
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<td>Agroforestry would be approved by:</td>
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<tr>
<td>Fellow farmers</td>
<td>3.0 1.0</td>
<td>2.3* 0.9</td>
<td>2.7 1.0</td>
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<td>Extension officers</td>
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<td>3.1* 1.0</td>
<td>3.5 1.0</td>
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<td>Scientists</td>
<td>4.2 1.0</td>
<td>3.5* 1.0</td>
<td>3.9 1.1</td>
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<tr>
<td>Agricultural policymakers</td>
<td>4.7 1.0</td>
<td>4.3 1.1</td>
<td>4.5 1.1</td>
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<td>Swiss public</td>
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<td>4.9 0.7</td>
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<td>Environmentalists</td>
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<td>5.6 0.8</td>
<td>5.6 0.8</td>
</tr>
<tr>
<td><strong>Effect on reputation</strong></td>
<td>4.4 1.1</td>
<td>3.5** 1.2</td>
<td>3.9 1.2</td>
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</tbody>
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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

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

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

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)

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

Create a free guest account at www.farmrise.ch!
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.
Thanks for your attention!
Chapter II: Profitability of Swiss agroforestry

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

NPV (SFR/ha)

Years 1-60

ARABLE MONOCULTURE  BASIC_A  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)
Silvopastoral practices
Hochstamm Aprikosen, Valais
Silvoarable agroforestry: Mostobst & Ackerbau (Sursee)
1.2) Bio-economic assessment

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
**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)

<table>
<thead>
<tr>
<th>Agroforestry practices</th>
<th>a) BASIC_A</th>
<th>b) BASIC_P</th>
<th>c) BASIC_O</th>
<th>d) ECO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timber (T)/ Fruits (F)</strong></td>
<td>SFR/ha in year</td>
<td>SFR/ha in year</td>
<td>SFR/ha in year</td>
<td>SFR/ha in year</td>
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<tr>
<td>Arable (A)/ Grassland (G)</td>
<td>10 30 60</td>
<td>10 30 60</td>
<td>10 30 60</td>
<td>10 30 60</td>
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<td>Arable monoculture</td>
<td>13'533 29'510 41'008</td>
<td>13'533 29'510 41'008</td>
<td>13'533 29'510 41'008</td>
<td>13'533 29'510 41'008</td>
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<td>Wild cherry (TA40)</td>
<td>10'182 24'579 35'763</td>
<td>10'182 24'579 35'212</td>
<td>10'182 24'579 36'315</td>
<td>14'128 33'827 47'258</td>
</tr>
<tr>
<td>Wild cherry (TA70)</td>
<td>11'001 27'328 40'019</td>
<td>11'001 27'328 39'207</td>
<td>11'001 27'328 40'831</td>
<td>13'805 35'261 51'411</td>
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<td>11'352 21'298 37'863</td>
<td>11'352 21'298 39'638</td>
<td>15'581 30'467 48'465</td>
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<td>13'113 23'487 46'920</td>
<td>13'112 23'487 45'683</td>
<td>13'112 23'487 48'156</td>
<td>15'183 32'091 60'020</td>
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<td>-1'661 23'442 38'049</td>
<td>-2'214 17'820 28'990</td>
<td>-1'246 27'658 44'844</td>
<td>5'027 32'491 48'265</td>
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<td>Walnut (FA70)</td>
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<td>-7'969 18'965 33'867</td>
<td>-6'429 34'616 59'089</td>
<td>1'136 38'847 61'360</td>
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<td>10'542 23'554 32'469</td>
<td>10'542 23'554 32'469</td>
<td>10'542 23'554 32'469</td>
<td>10'542 23'554 32'469</td>
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<tr>
<td>Wild cherry (TG40)</td>
<td>7'903 23'106 36'629</td>
<td>7'903 23'106 35'212</td>
<td>7'903 23'106 37'196</td>
<td>12'095 32'333 47'285</td>
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<td>Wild cherry (TG70)</td>
<td>8'642 26'618 43'435</td>
<td>8'642 26'618 42'599</td>
<td>8'642 26'618 44'271</td>
<td>9'815 30'251 50'095</td>
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<td>8'051 11'561 25'376</td>
<td>8'051 11'561 27'152</td>
<td>12'574 22'598 40'513</td>
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<td>Walnut (TG70)</td>
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<td>8'978 17'271 39'289</td>
<td>8'978 17'271 41'761</td>
<td>6'679 25'652 51'596</td>
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<td>Walnu (FG40)</td>
<td>-5'426 16'893 33'973</td>
<td>-5'526 14'602 29'603</td>
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<td>Wild cherry (FG70)</td>
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<td>-12'242 19'894 46'674</td>
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<td>-4'992 10'701 20'302</td>
<td>-4'024 20'539 36'155</td>
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<td>Walnut (FG70)</td>
<td>-10'826 20'941 41'158</td>
<td>-11'706 11'997 26'746</td>
<td>-10'166 27'648 51'968</td>
<td>-3'698 31'452 53'131</td>
</tr>
</tbody>
</table>
Silvoarable Walnut/Timber 70 trees/ha
Scenarios: BASIC_A, BASIC_P, BASIC_O and ECO
Silvoarable AF

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

Poplar shade:
(C. Dupraz, Venezobres, France)
Silvopastoral AF
Windbreaks

Tree Allée

Baumreihen- und Alleenkampagne: [http://www.pronatura.ch/lv](http://www.pronatura.ch/lv)
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

a) Wild Cherry silvoarable agroforestry

b) Walnut silvoarable agroforestry

c) Wild Cherry silvopastoral agroforestry

d) Walnut silvopastoral agroforestry

Konkurrenz
- 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)

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

Relativer Ertrag von Ackerkultur

Ertrag Ackerkultur bei W 40 Vogelkirsche/ha

Ertrag Wertholz bei W 40 Vogelkirsche/ha

Zeit [Jahre]