Short Rotation Coppices within agroforestry – options and limitations

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...... in today's agriculture, we have, at least, **three major ecological problems:**
1. Nitrogen / Nitrate pollution

Mecklenburg-West Pomerania

DPA / NWZ (18.06.2012)
2. Soil erosion
3. Loss of Biodiversity
......... the solution?

Promoting tree growth on agricultural ground, to

- protect soils against erosion (actually, not a new idea!)
- extensify and buffer soils and waters from pollutions
- foster structural biodiversity
- increase C-sequestration
- ....

i.e., promoting Agroforestry
At least, one additional problem:

We need more wood!
Projected use and availability of woody resources in 2020, Germany

There will be a "wood gap" of ca. 270 PJ/a, i.e. a lack of 1-2 Mio. ha of land for woody biomass production.

Ref.: German Biomass Research Center (DBFZ), 2009
.......... the solution:

Short Rotation Coppice (SRC) with fast growing trees?
what is SRC?

... a cultivation with fast growing trees (mostly polar and willow clones) to produce in a minimum of time a maximum of woody biomass

... a cultivation of trees on farmland, accepted as a "common agricultural praxis", as long as trees are harvested latest every 20 years

... a tree based land use system which may provide additional ecological services (e.g., less fertilizer & pesticides)

... a system which may also include serious drawbacks (e.g., enhanced water consumption, loss of open space, "monoculture effects")
Plot size, boundary structure and bird occurrence

Smaller plot sizes and enriched boundary structures favor species richness

Site "Georgenhof" (Hessen/ Germany)

vTI Agriculture and Forestry Research (Landbauforschung) 2009 (Vol. 59/3)
My focus today: **The impact of SRC on:**

- Nitrate leaching
- and
- Ground water recharge (GWR)
The drinking water catchment area
"Fuhrberger Feld"

RATING-SRC
Reducing environmental impacts of SRC
through evidence-based integrated decision support tools
The drinking water catchment area
"Fuhrberger Feld"

- 30 km north of Hannover/Germany (size: 308 km²)
- Providing ca. 90% of the drinking water for Hannover (44 million m³/a)
- Mostly light sandy soils
- Previously, intensive managed cropland, incl. water table reduction
The drinking water catchment area "Fuhrberger Feld"
- Specific features -

• A serious nitrate problem
Nitrate in near-surface Groundwater, "Fuhrberger Feld"

Winter 2009/10, 3 m depth, n = 3 / plot

Selected sites due to treatment effect observations
The drinking water catchment area
"Fuhrberger Feld"
- Specific features -

• Since > 20 years, protection of groundwater sources by leaving sites fallow
The drinking water catchment area "Fuhrberger Feld"

- Specific features -

• Plus, since 1994, installation of SRC as a strategy to combine groundwater protection and woody biomass production
SRC research plots "Fuhrberger Feld"

Poplar, planted in 1994  (P94)

www.ratingsrc.eu
Willow, planted in 1994  (W94)
Reference plot / fallow ground  (Ref)
Poplar, planted in 2009  (P09)
NO$_3$ in soil solution
Standard P-80 suction lysimeter cups, 100 cm soil depth, bi-weekly sampling, $n=5$ pro plot
NO$_3$-N in soil solution
100 cm soil depth, monthly mean
(Feb 2010 - Jun 2011)

NO$_3$-N [mg/L]

Drinking water threshold value (11.3 mg/L)

No solution due to drought

Ref
NO$_3$-N in soil solution
100 cm soil depth, monthly mean
(Feb 2010 - Jun 2011)

NO$_3$-N [mg/L]

- Ref.
- P09

No solution due to drought

Ref
NO₃-N in soil solution
100 cm soil depth, monthly mean
(Feb 2010 - Jun 2011)

NO₃-N [mg/L]

- P09
- P94
- Ref.

No solution due to drought

Feb      Mar      Apr      May      Dec      Jan      Feb      Mar      Apr      May      Jun
NO$_3$-N in soil solution
100 cm soil depth, monthly mean
(Feb 2010 - Jun 2011)

NO$_3$-N [mg/L]

- P09
- W94
- P94
- Ref.

No solution due to drought

No solution due to drought
Groundwater Recharge (GWR) under SRC, "Fuhrberger Feld"

Precipitation*: 650 mm (mean)

- **Forest**
  - EvpTr: ~500 mm
  - GWR: ~150 mm
  - (23%)*

- **SRC**
  - ?
  - (~ 40%)*

- **Field**
  - 400 mm
  - ~250 mm

*Values are approximations.
Measuring and modeling the water and energy fluxes

Variables in high resolution:
- Precipitation
- Temperature
- Humidity
- Wind speed
- Global ration

Soil matrix potential
(30, 60, 100 cm soil depth)
Groundwater Recharge (GWR) under SRC, "Fuhrberger Feld"

Precipitation*: 651 mm (2010, willow)

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<thead>
<tr>
<th></th>
<th>Forest</th>
<th>SRC</th>
<th>Ref. plot</th>
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<tbody>
<tr>
<td>EvpTr.:</td>
<td>~ 500 mm</td>
<td>462 mm</td>
<td>308 mm</td>
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<tr>
<td></td>
<td>(23 %)*</td>
<td>(29 %)*</td>
<td>(53 %)*</td>
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<tr>
<td></td>
<td>~150 mm</td>
<td>189 mm</td>
<td>345 mm</td>
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Conclusions

SRC plantations

• offer promising options to supply additional wood sources while simultaneously providing ecological services in today’s agriculture

• should be better integrated in the given agroforestry approach to optimize added-ecological values and to avoid negative effects

• should be treated as a component to increase the economical and ecological value of a given landscape
Thank you for your attention