



## Planting orange orchards to curb soil erosion, China – the Ningdu county's Meijiang watershed

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**Short title:** Erosion prevention through orange orchards.

**Key Message:** Orchards of Navel oranges were established in the Meijiang watershed in order to reduce soil erosion and maintain water supply by making erosion measures a prerequisite to orchard developers.

**Reviewer:** Prof. Minjuan Zhao.

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### What was the problem?

The Meijiang watershed is based in the Ningdu County, southeast of the Jiangxi Province in Southern China. The watershed is known for its orange production but also for its soil erosion caused by steep slopes and heavy rainfalls (approx. 1500 mm annually). Remote sensing data from the year 2000 show that around 24% (i.e. 979 km<sup>2</sup>) of the land in Ningdu suffered from soil erosion, of which 615 km<sup>2</sup> were medium heavily eroded. Soils in the hilly areas are not very fertile, but the combination of water supply (rain), sunshine and temperature are favourable for navel orange production.

### What was done to solve it?

The local government initiated a programme for the Meijiang watershed conservation in 2003. Various activities were put in place such as the creation of protected areas, soil and water conservation forests etc. One of these activities links agricultural production with financing conservation measures. In order to improve agricultural productivity while at the same time reducing soil erosion and increasing water supply, a new system of orange production was promoted.

### Which ecosystem services were examined and how?

The ecosystem services aimed for were prevention of soil erosion (regulating service) and water conservation (provisioning service). Traditionally the orange orchards were small (average 1ha). According to the analyses of local officials these small orchards generated not enough financial returns for farmers to invest in conservation measures. Thus, the county government issued licenses to orchard developers under the following conditions:

- 1) The orchard developer follows a soil conservation plan, which is subject to inspections by government agencies on a regular basis after orchards are established;
- 2) the orchards have a minimum size (more than 100 mu<sup>1</sup>, i.e. 6.7 ha) which guarantees big enough financial returns to be able to invest in conservation activities;
- 3) The orchard developer holds a certified land lease contract.

The conservation plan for conserving water and preventing soil erosion include activities like:

- the preparation of terraced strips for planting orange seedlings;
- the construction of level ditches on these terraces to conserve water and
- the planting of Bahia grass (*Paspalum notatum Flugge*) on the edges of the terraces in order to prevent soil erosion (Leshan, J. et al. 2005).

The government introduced a legal base for leasing out small plots in order to facilitate the pooling of large areas for orchard development. Based on this, state agencies organized a system which allowed developers/ investors and small landholders in the Meijiang watershed to cooperate. Village committees act here as a kind of broker. They combine small plots of land held by individual households into larger areas (at least more than 7 ha each).

The village committees then invite investors (of which approx. 40% of investors are external and 60% are local i.e. government officials and businessmen) to develop orange orchards (Porras / Neves 2006). The committee members are elected by farmers. Committee members are paid from public finance and the committee often acts as the lowest level of government. According to some observers, the village committee are biased towards the orchards' development and often follow orders from a higher level of government (municipality or county).

The county government subsidizes the village committee with \$281/ha for building roads, power systems, water supply systems as well as other infrastructure to attract investors. It also subsidizes developers with 50 yuan/mu (i.e. \$93/ha – if an orchard has the sizes of at least 20ha) for conservation activities. It seems, however, that these subsidies were not necessary. Many developers said they would invest in conservation works regardless of the subsidy because of the high returns.

Estimates of costs and returns for the developer indicate (Leshan, J. et al. 2005):

- Initial conservation costs: \$187/ha (with access to government subsidies of US\$94/ha for orchards over 20ha);
- Land leasing to village committee: US\$18-36/ha/yr;
- Production cost: US\$200/ha/yr
- Marketing cost: US\$50/ha/yr
- Average (minimum) price: US\$375/ton
- Average production per year: 41.25ton/ha

This allows developers to make enough profit to sustain conservation measures after the initial investments in conservation and public subsidies.

The land is usually rented by the developer from local households for 30-70 years for a lease of US\$18-36/ha/year (Porras, I. and Neves, N. 2006). This is supposed to secure income for local landholders with a long term perspective, but might also restrict people to a specific

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<sup>1</sup> Mu is a Chinese unit of measurement. 1 mu = 1/15 ha.

development path and deprive individual households from looking for innovative solutions and alternative land uses or other concepts of PES.

The amount of the rent local households receive is set by the county government ((between US\$18-36/ha/yr). Households can benefit from the lease as well as from wages, when developers hire local farmers to prepare the land, plant seedlings, apply fertilizer and pesticides as well as maintain the orchard. The wage for a long-term worker in an orchard is about 500 yuan/month (\$62/month). The wage for seasonal labour reaches 16-24 yuan/day (\$2-3/day). In order to manage an orchard of 400 mu (27 ha) it is necessary to hire 20 long-term workers (work year-round except busy farming time) and additionally seasonal labourers. The average net income for a Ningdu farmer is 1,800 yuan/yr (\$225/yr) (Leshan, J. et al. 2005). It is too early to conclude to what extent local people really find long-term jobs in the orchards and are committed to the conservation and production scheme as well as what are the distributional effects of this scheme.

### **What policy uptake resulted from examining the ecosystem services?**

About 1,333 ha were leased out in 2003, and another 1,000 ha in 2004.

### **Lessons learnt**

The approach shows how agricultural development can be combined with the provision of ecosystem services such as the prevention of soil erosion and conservation of water. The measurements had, however, ambiguous effects, at least for the first years. According to interviews of representatives of the local government and people the impacts were:

- to a certain extent contra productive in the sense that soil erosion increased in the first three years of orchard development (for building terraced strip, level ditch, bamboo ditch, and planting). Erosion was, however, expected to ease off afterwards;
- uncertain with regard to water quantity conserved. Opinions among interviewees are almost equally divided, half saying that water flow had increased and half that it had decreased and
- even negative looking at the increased amount of fertilizers and pesticides applied in orchards which affected the water quality.

Trade-offs have to be made. However, focusing too much on development in combination with only one or two ecosystem services can be a risk, especially if planned at bigger scales. Local biodiversity might suffer. The water quantity might increase, while the quality decreases due to, for instance, the introduction of critical amounts of fertilizers and pesticides. The fundamental base of the concept of ecosystem services with regard to conserving biodiversity is that needs of the local communities or people have to be taken into account.

Concluding, PES can be part of agricultural development projects if (1) the legal and institutional framework is set in the sense that these payments for conservation measures become a prerequisite, stakeholders are committed to them and they are later seriously monitored, (2) the cooperation and participation of the local population is sufficiently addressed and (3) the profit margins of the agricultural production are high enough for potential developers to invest in conservation measures.

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