Could smallholder agroforestry Seed and Seedling input-supply be improved?

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Agroforestry, Landscape restoration and germplasm

Efficient germplasm (seed and seedlings) input supply requires:

- **adapted productive planting material (germplasm)**
- **species that useful to rural people and/or have product markets**

Germplasm input supply thus requires:

- *a large number of quality seed sources (many species and environments)*
- *efficient distribution networks for seed and seedlings*
- *well organised networks and hubs for information flows*

Agroforestry, Landscape restoration and germplasm

Current situation:

Germplasm delivered to smallholder farmers generally has a quality

that would be considered unacceptable

by the industrial tree plantation or agriculture sectors

Seed source classification

I. seed orchards - In terms of improving growth and quality of tested material - usually the most important type Seed production areas (SPAs) at the low end of intensity (low investment) contain mixtures of a diverse set of seed families, while at high intensities orchards are part of a detailed breeding strategy: e.g. Breeding Seedling Orchards (BSOs)

II. Natural forests are also important sources of materials for improvement, and there are typically substantial genetic differences in productivity among different natural provenances (geographic sources).

III. Vegetative propagation (cloning) is prominent in agroforestry for propagation of selected ideotypes of fruit trees

IV. Farmland sources (remnant or planted trees of unknown origin in agricultural landscapes) In terms of genetic quality - a source characterized by minimum knowledge on genetic quality and maximum risk of low quality in particular for low density species

V. Plantations (trees planted in) may often serve as high producing seed sources, where seed collection is easy

Defining <u>genetic quality</u> and <u>logistics</u> of production and distribution

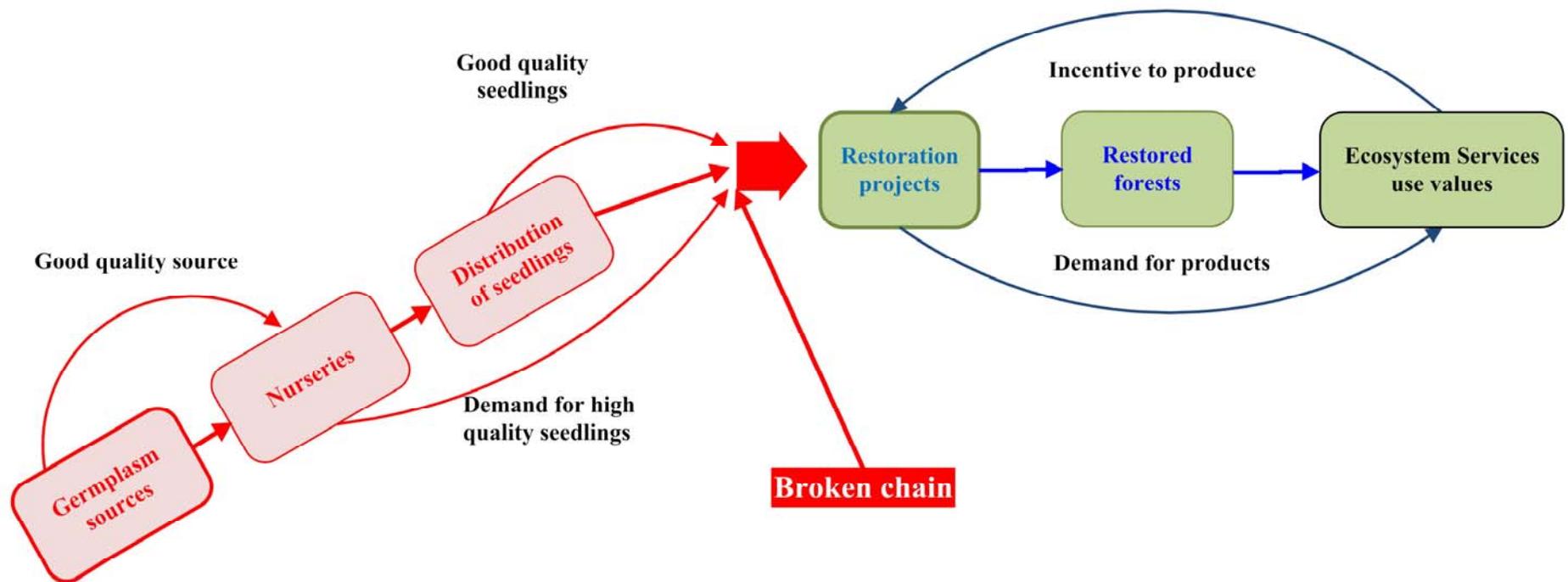# Provision of germplasm is characterized by the **BROKEN CHAIN**

Input supply and value chains in agroforestry
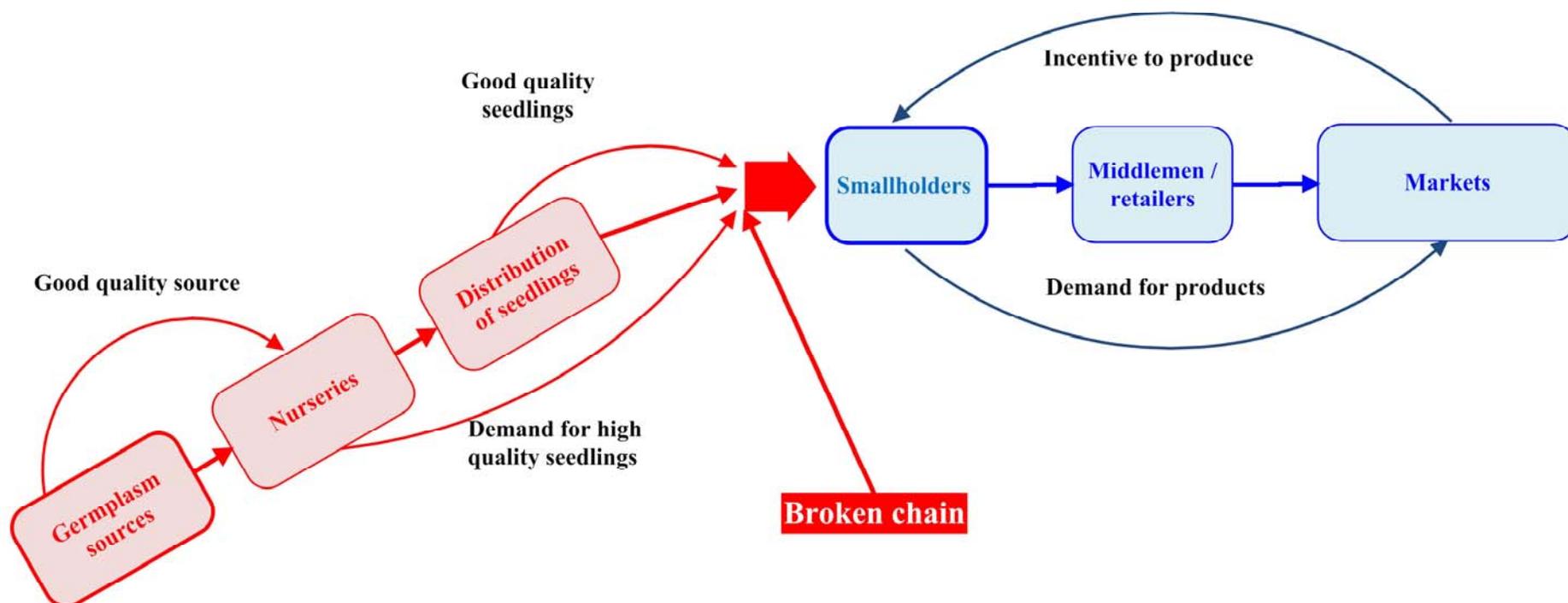
Sources and nursery networks are not integrated into value chains

Provision of germplasm is characterized by the **BROKEN CHAIN**

Input supply and value chains in restoration

Sources and nursery networks are not integrated into value chains

Why the broken chain? - Institutional constraints, not technical

A key problem causing the broken chain is a focus on supply to meet short term planting targets => projects financing collection of seed and distribution of seedlings

Symptom of the market failure = predominant use of *farmland seed sources*, which are poor substitutes for good quality seed sources (*seed orchards and natural forests*).

This approach can be called "the NGO model"

Ideal alternative : create demand-based production and distribution networks

<=> investments in quality sources + seedling distribution networks + knowledge networks

Changing from supply-driven to demand-driven systems

The inspiration for the term "the NGO model"

Constraints for input supply to smallholders – crop seed and agroforestry seed

Agricultural crops:
Wiggins and Cromwell (1995): A fundamental problem in seed supply of certified modern crop varieties to smallholders is **transaction costs distorting seed markets => smallholders limited access**

=> problems of asymmetrically held information, resulting in market failure since *farmers do not know what is on offer and what difference it might make to their livelihoods, while sellers know too little about what farmers may demand*

Agroforestry crops (woody species)
This argument corresponds, in **agroforestry**, to the use of **farmland sources (own saved crop seed)** versus obtaining seed from **BSOs (modern crop varieties).**

Wiggins. S. and Cromwell, E. 1995. NGOs and Seed Provision to Smallholders in Developing Countries. World Development 23(3): 413-422.

The NGO model in agriculture and agroforestry

The inspiration for the term "the NGO model"

Agricultural crops:
NGOs have become dominant in the delivery of seed to smallholders by **absorbing most of their transaction costs**.

Wiggins and Cromwell (1995) pointed out that scaling-up "the NGO model" would be prohibitively expensive

Agroforestry crops (woody species)
Same problem, but problem accentuated for agroforestry:
demand and supply calculations at a landscape level, to **justify investments in seed sources** and **through efficient distribution networks across very large areas**.

(because tree seed sources produce large amounts of seed versus individual farmer demand for few seed (seedlings)

The NGO model in agriculture and agroforestry

"The NGO model" in agroforestry

The NGO model in agroforestry

NGOs generally organise and supply tree seeds and seedlings on a **relief basis (free of charge**) thereby replicating approaches that have been severely criticized in crop seed systems, and undermining the business of the existing networks of small-scale commercial nursery operators and potential seed source owners.

Genetic quality of most of the material distributed (farmland seed sources) has not been widely tested and distribution has often taken place with little, if any, concern for genetic management of the species.

The NGO model has been successful for some early seeding species – not for the majority of agroforestry species

Alternatives to "the NGO model" - (a) Tropical "plantation" crops

Tropical "plantation" crops – Rubber, Coffee, Tea and Cocoa.
For the commodity crops (cocoa, tea, coffee, rubber) **intensive breeding programmes** with well known improved varieties and downstream value chains constitute one model, often dominated by large transnational companies.

Access to improved varieties, however, remains a key constraint for smallholder productivity. The levels of adoption of best possible planting material are very variable and often far below what would be socially and economically desirable.

An important advantage of large estates is clearly their ability to access and utilise higher yielding planting material. **Well governed state programmes or collective action can compensate for this**

**Intensive levels of breeding correspond to high levels of demand (but not quite)
Efficient distribution networks to smallholders – not pervasive**

Alternatives to "the NGO model" - (b) Outgrower schemes

Outgrower schemes for wood production –Pulpwood in Vietnam, poplars in India.
A characteristic of large scale industrial forest plantations in the tropics is the **use and breeding** of well-defined planting material.

Two prominent examples are programmes for domestication of **acacias in Vietnam** and of **poplars in northwest India**, involving around 200,000-250.000 smallholder growers in each country, growing improved trees.

Both programmes continuously improve the quality of planting material and major efforts are placed in **distribution networks** as well as the **communication of improved practices and technologies** to thousands of smallholders.

High intensity of breeding for specific product and market

Promising alternatives to the NGO model - (c) low-input breeding

Application of low-input breeding strategies for many species in many different environments.

Two types of low-input approaches have been tried out, which could be applied to domesticate a much larger number of promising agroforestry species:

West Africa: participatory plant breeding of indigenous fruits: Successful in West Africa, is participatory plant breeding of indigenous fruits, where superior **clones** are identified and propagated in collaboration between scientists and smallholder farmers.

Zimbabwe: breeding exotic timber trees; Nepal: breeding indigenous species
The other model is based on a Multiple Population Breeding Strategy, which basically consist of testing the genetic variation of trees while at the same time producing **seed** for specific environments across landscapes in BSOs. This model has been tried out in Zimbabwe and Nepal and include several levels of breeding intensity

Matching levels of breeding to large numbers of species

Alternatives to the NGO model - (c) low-input breeding (cont.)

For most agroforestry species, low-input breeding is the most promising alternative:

Challenges for low-input breeding:

(i) Establish recommendation domains for sources of species that are planted in the <u>landscapes</u>

(ii) Establish levels of breeding intensities <-> expected benefits from breeding in <u>production systems</u>

(iii) Establish sustainable demand-driven distribution networks (nurseries) in <u>landscapes and servicing production systems</u>

<u>(iv) Create incentives to manage the Breeding Seed orchards?</u>

What we need to do

Demand-driven input supply and value chains in agroforestry
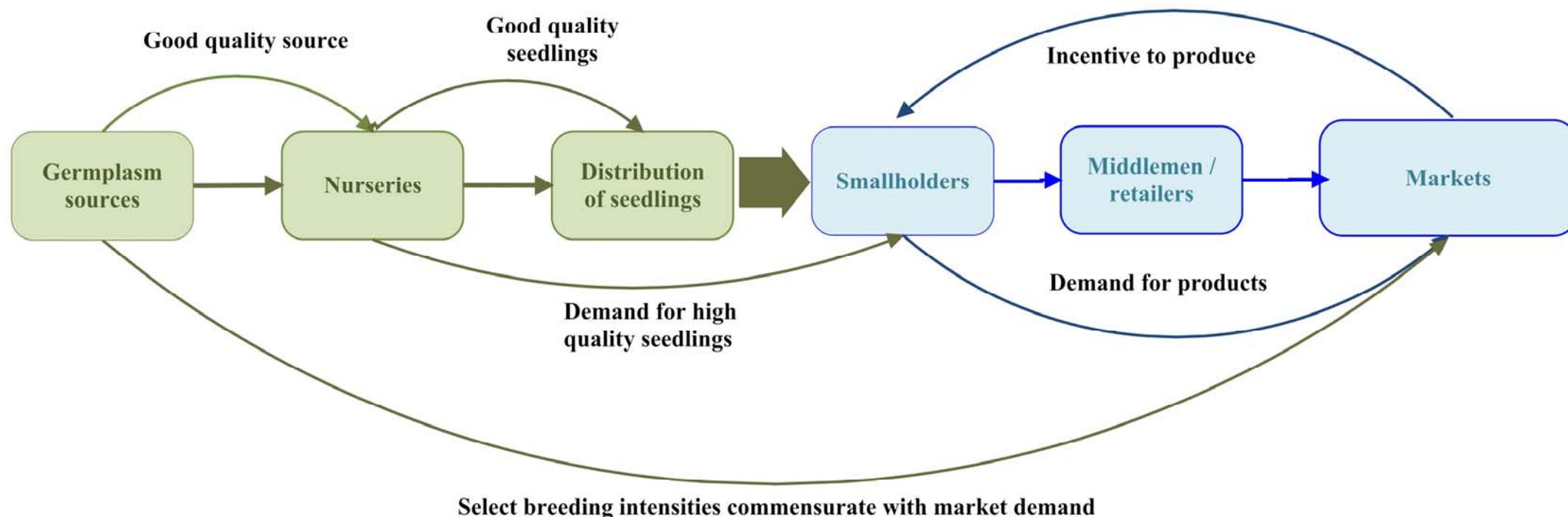
Focus on (many) promising species within production systems and landscapes

Develop species/product specific demand-driven value chains

Mending the broken chain? - Institutional constraints, not technical
How to get there?

The institutional constraints for **tree seed and seedling** inputs are the same as for **crop seed**

A solution would require solving a bundle of constraints, much like the
approach of AGRA (Alliance for a Green Revolution in Africa)

Agroforestry needs a similar alliance –
Alliance for an Ever-Green Revolution in .....?

Finding a balance between public and private roles