

Zeitschrift: Schweizerische Zeitschrift für Forstwesen = Swiss forestry journal = Journal forestier suisse

Herausgeber: Schweizerischer Forstverein

Band: 153 (2002)

Heft: 10

Artikel: Agroforestry : a way forward to the sustainable management of the Walnut Fruit Forests in Kyrgyzstan

Autor: Messerli, Sirocco

DOI: <https://doi.org/10.5169/seals-1098257>

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Agroforestry – A way forward to the sustainable management of the Walnut Fruit Forests in Kyrgyzstan

SIROCO MESSERLI

Keywords: Agroforestry; sustainable forest management; Walnut Fruit Forests; Kyrgyzstan. FDK 26 : 935.1 : (58)

1. Introduction

Kyrgyzstan – a small mountainous country in Central Asia – possesses over 34 000 ha of Walnut Fruit Forests (VENGLOVSKIJ 1998), occurring naturally but also planted/grafted walnut (*Juglans regia*) mixed with apple and plum varieties. In addition, these forests produce over 90 different non-timber forest products (NTFPs)¹ ranging from walnuts, wild and domesticated apple and pears, Sogdian and other plums, apricots, pistachio, hawthorn, rose-hips, berries, mushrooms and honey to firewood, as well as about 1200 medicinal herb species (BEDOLLA 1999). The livelihood of more than 100 000 people depends to a large extent on the natural resources of these forests and the surrounding mountains. The settlements of the local population are mainly concentrated in the valleys at 1000 to 1500 m asl. Whilst the lower plains and valley bottoms are characterised by dry steppe and patches of mostly irrigated agriculture, the hillsides above are mostly forested. Above the tree line, fertile alpine pastures are abundant, reaching up to 3000 m asl. This so-called «jailoo» is used communally for the grazing of private livestock and, increasingly, over the last few years, for subsistence arable cropping. Cropping activities usually take place on small plots leased by the farmers from the leshoz (state forest enterprise) or sovkhos (state agricultural farm) (figure 1). Recently, forest leases to the locals have increased, entitling them, in most cases, to the collection of firewood, walnuts and fruits under the condition that they safeguard the concerned forest and contribute to afforestation efforts. The concept of forest leases and their primary realisation within the framework of two model leshozes was initiated in close collaboration between the Kyrgyz State Agency for Forestry and Kirfor, a forestry programme implemented by Intercooperation on behalf of the Swiss Agency for Development and Cooperation (SDC). The following text is based on the outcome of a survey conducted over a period of nine months within the Kirfor programme by the author in 6 of the 14 leshozes in the mountains of Southern Kyrgyzstan (MESSERLI 2001).

2. The growing importance of agriculture

In the Soviet past almost all inhabitants living in the Walnut Fruit Forests were employed by the leshoz and/or sold walnuts, forest fruits or medical herbs to these state enterprises. Private cultivation of arable crops or vegetables or the keeping of private livestock was not widespread, even where it was not actively discouraged by the local administration. However, this survey shows that the majority of the population today considers arable cropping their most important source of in-



Figure 1: Typical multifunctional land use in the Walnut Fruit Forest area of southern Kyrgyzstan.

come, followed by animal husbandry. Livestock, once the centrepiece of Kyrgyz nomadic tradition, has lost some of its importance as a means of survival due to the impoverishment of the villagers and the increasing transformation of former pastures and hay meadows into arable fields for subsistence production. Rising food prices and the decreasing availability of food has heightened the interest in private cropping activities for subsistence (and to a lesser degree for sale). Arable crops are seen by the local inhabitants as a more attractive way to generate income than NTFPs thanks to a reliable annual yield. This is closely linked to the unreliability of the walnut harvests, which generate additional cash in good harvest years, providing the means to purchase consumer goods, but fails to support the daily living expenses during the many years with mediocre or low yield. Apples, plums and other fruit, which grow abundantly in the forests, as well as medicinal herbs, are hardly collected by the locals any longer, as nearly all former processing units have closed down following failed privatisation efforts. In the interviews conducted during the survey, surprisingly little mention was made of gathering firewood in the forests, although it is probably the main NTFP provided by the forests, apart from walnuts. Perhaps most locals take its supply for granted. However, in regions with higher population densities, the unsustainable extraction of firewood (and the extension of arable fields into the forests) are leading to the first signs of deforestation. The villagers in these regions attribute the gradual degradation of the forests not only to the growing population, which increases the demand for firewood, but also to the increasingly common practice of uncontrolled grazing of livestock in the forests.

3. Uncontrolled grazing and afforestation

During Soviet times large communal flocks of sheep and herds of cattle caused serious erosion problems on pastureland which are still visible today. Nowadays, the problem of

¹ The term «non-timber forest product» encompasses all biological materials other than timber which are extracted from forests for human use. These include foods, medicines, spices, ornamental plants, wildlife, fuelwood and raw materials such as smallwood and fibres (DE BEER & McDERMOTT 1996).

overgrazing is caused less by the size of the herds than by their distribution. According to estimations by mountain farmers, most livestock owners in the Walnut Fruit Forest area keep on average only two cows (including calves), one donkey (or – in the case of the better off – a horse) and (if at all) two to three sheep.

While alpine pastures are abundant, pastureland near settlements is often limited, either because the village lies in the forest, or because the land in the vicinity (which can often be irrigated) is occupied by arable fields. In the past transhumance was practised during summer with uncontrolled or shepherded grazing on the jailoo. The impoverishment of the villagers and the rapid disintegration of community organisation has led to the farmers' increasing refusal to pay the leshoz for seasonal grazing rights on the communal alpine pastures. Instead, livestock is released in the morning, allowed to stray freely in the forests in village vicinity during the day, and to return unaccompanied in the evening. This saves them the costs of grazing rights and no shepherd needs to be employed.

A further problem has emerged with the extension of arable cropping around the villages and on forest clearings: most hay meadows, which were formerly used for autumn grazing, have disappeared as well. Livestock owners are therefore forced to graze their animals in the forest during autumn and, as less hay is produced and the costs for transporting hay from remote meadows to the village have increased, also in winter and early spring. The result is a paradox situation where the alpine pastures and meadows on the jailoo are being underused while undergrowth in forests and pasture in forest clearings are frequently overgrazed.

Uncontrolled grazing in the forest is disturbing the natural regeneration of the forest (STADLER 1995) (*figure 2*). Even afforestation efforts through planting are often unsuccessful. However, the mountain farmers emphasised that they support the afforestation efforts of the leshozes, which are currently concentrated on former pastureland. Their support is conditional on the afforestation being undertaken on areas at a distance from the village or on steep slopes and erosion-prone sites. It was pointed out that afforestation can lead to the loss of valuable arable land or hay meadows and thus deprive farmers of their subsistence agriculture. This is especially important to the poorer farmers without animal husbandry, who are entirely reliant on arable cropping. Generally, the mountain farmers' perception of arable land scarcity depends very

much on the amount of land they have at their disposal, as well as on the distance of the plots from their home. On the territories of the leshozes with high population pressure, the consequences of insufficient arable production is an increasingly uncontrolled extension of arable fields into the forest as a common land resource. Interestingly, arable land is not scarce in these areas, but the extensive irrigation systems built during Soviet times have deteriorated or no longer work, and the productivity of the land is therefore far below its potential. In areas with large forest cover the lack of sufficient open land could increase future pressure on the forest, although the population in these leshozes is not (yet) very high.

However, as pointed out above, the majority of the mountain farmers participating in the survey are interested in tree planting or have even started to plant trees under new lease contracts with the leshoz. These farmers undertake regular tree management operations, such as pruning or felling of diseased and dead trees and they consider NTFPs to be an important part of their income. The interest in forest protection and long-term sustainability is high, this is further fostered by the strong socio-cultural ties of the local population to «their» forest (i.e. forests are commonly referred to as a symbol of beauty or richness and they are aware of the importance of the forests for clean air, water resources and for the livelihood of future generations).

4. Orchard management

As young walnut trees are not shade tolerant, most forests are not very dense and allow for haymaking, not only in forest clearings and other open areas but also under and between the trees. The meadows consist of a mix of wild grasses and herbs. In general they:

- are neither irrigated nor fertilised,
- have not been oversown or resown for at least 10 years,
- are grazed by livestock returning from the higher mountain pastures in autumn.

The low quality and yields of the meadows are further reduced by the very late hay cut, as the mountain farmers opt for maximum quantity and not quality.

Many mountain farmers also cut hay in apple, peach, pear, plum or damson tree orchards, or in the predominantly drier areas between the rows of apricot, almond and pistachio

trees. Row spacing varies from 3 to 10 meters and tree spacing from 2.5 to 8 meters. Mature orchards are sometimes grazed and smallhold farmers often use the inter-row strips of orchards to grow potatoes, sunflowers, maize and vegetables (*figure 3*). The size of these orchards, planted mostly during the Soviet era, varies considerably from half a hectare up to nearly 100 ha. However, the farmers show a certain amount of interest in establishing new orchards which increases in line with the decreasing Walnut Fruit Forest cover in the vicinity of their villages. Another factor influencing orchard establishment is land and tree tenure. According to the Kyrgyz Forest Codex, all forest land (including the trees and thus all orchard trees on leshoz land) is state property. Although only a few orchards are



Figure 2: About 60–70 % of the trees in the Walnut Fruit Forests are very old and over-mature. Natural regeneration is seriously impaired by uncontrolled grazing of livestock.

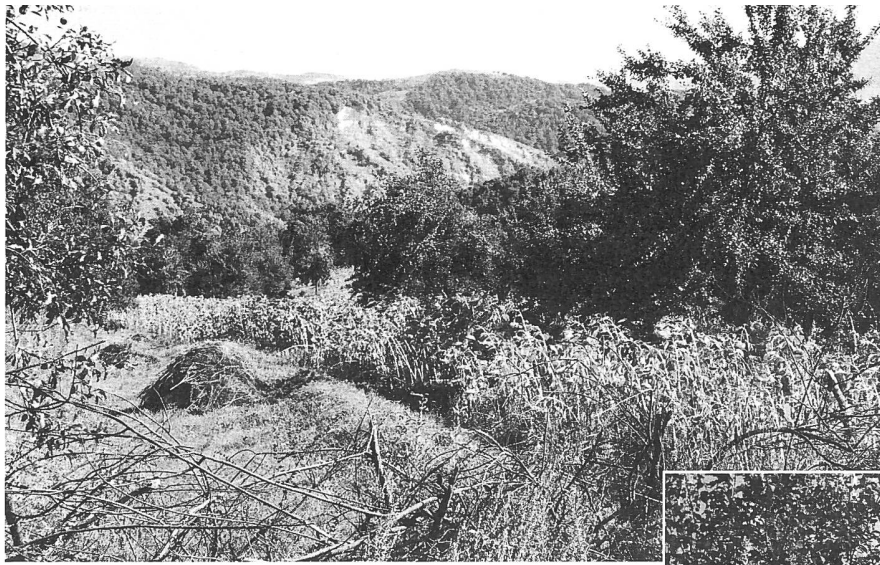


Figure 3: The land between orchard trees is generally used for haymaking or for growing sunflowers, maize or potatoes.

still completely run by leshoz staff, all decisions concerning the felling of dead or diseased trees, thinning of tree density, or the planting of new trees, etc. are still taken by the leshoz administration. The tenants have to fulfil the directed management operations in co-operation with leshoz workers. In return they benefit by holding usufruct rights on fruit and nut yields of varying percentages and/or the right to use the inter-row strips for hay making, grazing or arable cropping. Various problems arise from this situation: Experience so far shows that the leshoz endlessly delays urgent measures, such as felling of old trees, because it has no direct incentive to involve its small staff in costly and laborious operations. This – together with the resulting decline of the productivity of the fruit trees – reduces the interest of the concerned tenants in the management of «trees which do not belong to them». Management is further complicated and user conflicts are unavoidable as in some cases neither usufruct rights nor duties are clearly outlined, or in certain orchards the tree tenants have no user rights for haymaking or cropping (or vice versa). Following factors further reduce the farmers' interest in planting orchard (or forest) trees:

- insecure land tenure without written contracts,
- unmarked plots,
- the widespread practice of giving out only seasonal usufruct rights.

An indicator of the reluctance of the mountain farmers on leshoz territories to manage orchard systems is the booming interest in the establishment of new orchards on the neighbouring hill lands on former sovkhos territory, where trees can be privately owned and managed.

In the Soviet past, some orchards were established with more than one tree species, which can be called multi-storey succession orchards (figure 4). The species combined are characterised by differing speeds of maturation and different life spans (e.g. apple and walnut). Once the apple tree yield starts to decline in old age, it loses the competition for light to the walnut trees, which are coming into their fruiting period. This means that the apple trees can be gradually felled. Innovative farmers outside the leshoz territories have taken over this concept by adding more species (poplar & damson tree & apple/pear or rose-hip & peach & apple/pear/cherry & walnut). Some are also increasing production by using the inter-row strips where, depending on the amount of light available, they first plant potato and vegetables, then use the spaces for hay (or grazing) and eventually for berry growing or as a tree nursery. This system allows quick returns on investment, maximises land use efficiency and allows farmers to combine irrigation and soil cultivation measures of trees and crops.



Figure 4: An example of a complex multi-storey succession orchard: The apple, pear and damson trees as well as the poplars were planted at about the same time. The damson trees, which are early yielding, and the inter-row cropping with potatoes or clover deliver an early return on investment.

Large scale terracing of orchards on steeper slopes, practised during Soviet times, has been abolished and is not a viable alternative for the future due to the lack of heavy machinery (bulldozers, trucks, etc.) and the high costs of building the terraces. However, the concept of forest orchards might become a solution for integrating the agricultural needs of the local population (vegetable production, hay making and grazing), with the aim of sustaining and protecting the valuable Walnut Fruit Forests. A forest orchard differs from a common orchard in the following:

- Arises out of a mixed secondary fruit forest or a forest plantation, which is opened up for inter-row strip cultivation. Therefore, tree density is lower than in the surrounding forest.
- Contains forest trees alongside fruit trees.
- During establishment not all forest trees and shrubs are felled and replaced with new plantings. Valuable forest trees and shrubs are retained (mainly walnut and apple as well as Sogdian plum (*Prunus sogdiana*), hawthorn, rose-hip or maple) and possibly supplemented with desired (fruit) trees.
- Improved fruit tree varieties are usually grafted onto wild on-site rootstocks of former forest fruit trees (e.g. wild apple, Sogdian plum).
- Trees are not necessarily in rows and tree spacing can be irregular.

All mountain farmers who were introduced to the idea of forest orchards during the survey welcomed their widespread creation, especially in forests close to the villages. In the long run, preserving a tree-covered landscape near the settlements with all its advantages is only feasible if the local population's needs (firewood, NTFP, grazing and hay making) are satisfied and the current situation of the forests as an «open access re-

source) is resolved. Although the forests near the villages might lose some of their authenticity and biodiversity, intensification strategies, such as creating more forest orchards, will better protect the biodiversity of the Walnut Fruit Forests in remote areas.

5. Arable cropping on forest clearings and in homegardens

Apart from inter-row cropping in orchards, arable crops are planted on forest clearings of various sizes as well as on the jailoo, whereas only scattered forest trees or small wooded areas can be found between the fields (*figure 5*). Potatoes and sunflower kernels and oil are essential products for sale, barter trade and subsistence, while maize and vegetables are planted purely for subsistence production. Over the last ten years, fields have not usually been fertilised for the following reasons:

- no availability or high prices of artificial fertilisers,
- high transport costs due to deteriorated road network and limited transport means,
- use of dried manure and all crop residues (even stalks and roots) for cooking and heating,
- no fallow periods due to the scarcity of arable land.

Crop rotations are uncommon and chemical treatment of pests, diseases and weeds has been discontinued due to the high prices of external inputs. However, the main yield restriction is the insufficiency – or even the complete lack – of irrigation water, as well as its fluctuating distribution over the course of the year. The fences around the fields are traditionally opened in autumn (or torn down by livestock herders) for the uncontrolled grazing of livestock. Private planting of (fruit) trees is therefore only possible on land that can be guarded close to the homestead. Apart from tree planting activities on leased forest plots (according to the contracts with the leshoz) most villagers plant their fruit trees (apple, pear, plum, peach, apricot) and poplars in their homegardens.

Rising food prices, dwindling purchasing power and increasing unemployment has led to a great increase in homegardens. The resulting produce (especially tomatoes, peppers, onions, cabbage, potatoes, maize, tobacco, sunflowers and grass or clover for hay) often contributes substantially to the subsistence needs of village households. The homegardens are sometimes enriched with dispersed fruit trees, or boundary trees and shrubs used as demarcations and for construction wood. It is notable that the diversity of included trees and the complexity of the homegardens increases with decreasing access to the forests and its products. Additionally, the interest in «on-farm» trees is high, as these trees are not state property and can thus be managed without interference from the leshoz.

6. Outlook

We conclude by emphasising that the potential destruction of these biodiversically rich forests through the uncontrolled extension of agricultural activities and rising firewood needs can only be avoided if the villagers gain the rights and knowledge to create productive agroforestry systems and given the possibility of rediscovering the value and abundance of NTFPs in their forests. The following is a selection of action priorities resulting out of this survey that should be dealt with in the near future (*figure 6*):

- Agricultural training and education for mountain farmers (e.g. improvement of fruit yields by timely and professional pruning; better quality hay due to overseeding of weedy

and gappy meadows and earlier cuts in summer; importance of fertilisation and irrigation)

- Extension of agricultural advice – currently restricted to lowlands – to mountain areas
- Participatory agroforestry research (e.g. interactions between common tree/crop combinations; economic viability of current or proposed agroforestry systems; carrying capacities for grazing; Participatory Technology Development (PTD) trials and demonstration plots concerning soil and water conservation, fertilisation and tree management)
- Secure tenure rights and the encouragement of stronger involvement of the mountain farmers in conservation efforts by giving them more responsibilities (e.g. participatory decision making; privatisation of tree tenure in orchards on leshoz land; further extension of the area under forest leases)
- Establishment of communal grazing systems (e.g. mandatory shepherds; fences around reafforestation areas; determination of forest areas where grazing is permitted; re-introduction of pasture rotations with long resting periods; enforcement of transhumance in summer; continuation of autumn grazing on hay meadows; propagation of stall feeding in autumn and winter)
- Fruit processing (re-establishment of small scale fruit and medicinal herb processing units will revive the multifunctional use of the Walnut Fruit Forest by creating a market demand for NTFPs)
- Awareness building for agroforestry systems within institutions (leshozes, Forest Department, research institutions) and among mountain farmers



Figure 5: Small forest clearings in the vicinity of the villages are planted with arable crops.



Figure 6: There is a huge scope for agricultural intensification by such simple means as improved irrigation, fertilisation, land use planning and farmer innovation.

Summary

The unique Walnut Fruit Forests in Kyrgyzstan are a good example of the multifunctional use of forests in temperate zones. Not only are non-timber forest products (NTFPs) collected but the land in and around the forests is used for grazing and haymaking, as well as for arable cropping and the establishment of fruit orchards. Apart from sustaining the lives of the local mountain people, the Walnut Fruit Forests are extremely rich in biodiversity and have an important function as a watershed for the Ferghana valley. The simultaneous dependence of the population on both agriculture and forest offers ideal conditions for the extension and improvement of existing agroforestry systems. However, solutions must be found concerning the practice of uncontrolled grazing, the insecure land and tree tenure situation, the low productivity of the existing land use systems, the lack of agricultural advice and training and the serious impact of firewood collection on the forests in order to safeguard the Walnut Fruit Forest's biodiversity while integrating the needs of the local population into forest management.

Résumé

L'agroforesterie, pour une gestion durable des forêts de noyer du Kyrgyzstan

Uniques en leur genre, les forêts de noyer et de fruitiers du Kyrgyzstan représentent un bon exemple d'exploitation forestière multifonctionnelle en zone tempérée. L'exploitation ne se limite pas à la récolte des produits forestiers, mais englobe également l'utilisation de certaines surfaces à l'intérieur ou autour des forêts comme pâturages, prairies de fauche, champs et vergers. Ces forêts sont essentielles pour les populations montagnardes locales. Elles recèlent une biodiversité très riche. En outre, elles jouent un rôle central quant à l'approvisionnement en eau de la vallée de Ferghana. La forte dépendance des populations à la fois de l'agriculture et de la foresterie constitue une condition idéale pour l'amélioration et l'extension des systèmes agroforestiers existants. Il est cependant nécessaire, pour conserver la biodiversité tout en intégrant les besoins de la population dans la gestion des forêts, de s'attacher à résoudre des problèmes tels que le libre parcours du bétail, les incertitudes liées à la propriété des terres et des arbres, la faible productivité des systèmes culturels actuels, les déficiences de la formation et de la vulgarisation agricoles et l'impact sérieux des prélèvements de bois de feu.

Traduction: CLAUDE GASSMANN

Zusammenfassung

Agroforstwirtschaft – um eine nachhaltige Nutzung der Walnusswälder Kirgistan zu ermöglichen

Die einzigartigen Walnuss-Fruchtwälder in Kirgistan sind ein gutes Beispiel für die multifunktionale Nutzung von Wäldern in gemässigten Klimata. Die Nutzung umfasst nicht nur das Sammeln von Walderzeugnissen sondern auch die Flächen im und um den Wald, welche als Weiden, Heuwiesen, Ackerflächen und für Obstanlagen genutzt werden. Abgesehen von der Sicherung der Lebensgrundlage der Bergbevölkerung spielen die Walnuss-Fruchtwälder eine zentrale Rolle für die Wasserversorgung des Ferghana-Tals sowie für die Erhaltung der Biodiversität. Die starke Abhängigkeit der Bevölkerung von der Land- und Forstwirtschaft schafft ideale Bedingungen für die Ausdehnung und Optimierung von bestehenden agroforstwirtschaftlichen Systemen. Dazu müssen allerdings die Probleme des unkontrollierten Weideganges, der unsicheren Situation bezüglich Eigentum an Land und Bäumen, der ungenügenden Produktivität der gegenwärtigen Landnutzung, des Mangels an landwirtschaftlicher Beratung und Schulung sowie der Auswirkungen des Brennholzsammelns auf den Wald angegangen werden, um die Biodiversität der Walnuss-Fruchtwälder zu erhalten, ohne die Bedürfnisse der lokalen Bergbevölkerung zu vernachlässigen.

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Author

SIROCO MESSERLI, Dipl. Ing.-Agr. ETH, Swiss College of Agriculture Department for International Agriculture, Länggasse 85, CH-3052 Zollikofen. E-Mail: siroco.messerli@shl.bfh.ch.