Mulberry (*Morus* spp.) cultivation to prevent and mitigate human–elephant conflict and ensure livelihood sustainability

Human–elephant conflict is a major conservation issue in elephant-range nations. A number of management methods have been developed and are now in use to avoid and mitigate this conflict. Human–elephant conflict continues to be widespread as the bulk of the present preventive techniques is based on site-specific elements that only provide short-term solutions, whereas mitigation strategies typically shift conflict risk from one location to another. Conflicts are more common in or around conservation zones that are close to densely human-inhabited regions. Elephant populations are close to humans in villages on the edge of national parks, communities bordering forest reserves and settlements within the reserves, and so confrontations are serious. Conflicts are common when humans infringe on animal habitats, such as farming in an elephant travel corridor, and when elephant food sources are depleted, forcing it to adapt to new conditions[1].

Elephant encroachment into human settlements has serious effects on the livelihoods and food security of rural communities. Equipment, crops, food, buildings and other personal belongings may be harmed or destroyed. One night might mean the loss of a season's worth of efforts and a months' worth of food supply to the rural communities who rely on subsistence farming. Injury or death of a person as a result of an elephant encounter has major ramifications for his/her family's productive capacity in rural areas. The farm's available labour is also considerably decreased with one fewer family member. It is essential to find solutions to this growing issue in order to mitigate its social, environmental, economic and political consequences. To avoid disputes from arising in the first place, protective tactics might be employed. Mitigation measures are intended to diminish the impact of a conflict once it has occurred and to make it less of a problem for the people.

Little research exists on elephant 'preferences' for particular crops. There are a few crops that elephants do not eat, such as chilli, ginger, onion, garlic, coriander, mint, flower crops, etc. but these are also damaged by them due to trampling[2]. We have observed for five years that mulberry foliage is not eaten or damaged by elephants, under all conditions at the Cauvery Wildlife Sanctuary belt in Karnataka, India, where human–elephant conflict is common.

Mulberry (*Morus* spp.) plants belong to family Moraceae. It is most commonly used as silkworm (*Bombyx mori* L.) feed, but it is also valued for its fruit (fresh, in juice, or as a preserve), as a tasty vegetable (young leaves and stems), for its medicinal benefits in infusions (mulberry leaf tea), for landscaping, and as animal feed, depending on where it is grown. Excess leaves and unfed leaves by silkworms during rearing are fed to cattle, sheep and goats in areas where mulberry is predominantly farmed for sericulture. Mulberry trees are abundant in mountainous locations, and their leaves are fed to animals and planted in the lowlands and on hilly grounds.

Mulberry has high palatability and is easily digested by herbivorous animals, which is one of its key benefits as forage. Protein concentration in the leaves and young stems ranges from 15% to 28% depending on the cultivar, and it has an excellent amino acid profile. There are no anti-nutritional factors or harmful substances, and the mineral content is high. Stem cuttings are commonly used to grow this perennial fodder, and it is collected by leaf plucking or cutting whole branches or stems. Mulberry yields more digestible nutrients than most conventional forages. The leaves can be used as a supplement for dairy cattle in place of concentrates, as a primary feed for goats, lambs and rabbits, and as a component in monogastric diets. Even if they have never been exposed to it before, small ruminants eat the new leaves and young stems of mulberry first. If the branches are not clipped, they can peel the bark off and devour it. If the biomass is finely diced, cattle will ingest it entirely. Animals initially prefer mulberry over other forages when they are offered simultaneously, and they even dig through a pile of various forages to look for mulberry[3]. However, mulberry foliage is a non-preference for elephants. This might be due to the presence of unique chemo-factors like morin and β-sitosterol in the leaves and also resistance to damage due to its growth pattern.

The most rational strategy to controlling human–elephant conflicts is to deploy protective methods to prevent them from arising in the first place, short-term mitigation techniques in areas where the problem already exists, and implementation of long-term preventive strategies. However, the cultivation of mulberry offers many advantages where such conflicts are regular or frequent, as it is perennial, fast-growing, with multipurpose usage, is easy to cultivate, and has wide adaptation. Therefore, the cultivation of mulberry for sericulture or any other purpose ensures livelihood sustainability while preventing and mitigating human–elephant conflicts in the forest belt areas.

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