

## PRIORITIES FOR LAND USE: A SOUTH AMERICAN EXAMPLE

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### SUMMARY

The Merenberg Forest Reserve is located in the east-central Colombian Andes and lies between 2,000 and 2,500 m above sea level. The average amount of rainfall is 2,000 mm and the mean temperature is 15°C. The forest is made up of primary and secondary highland hardwood species dominated by *Quercus humboldtii* Bompl., *Billia columbiana* Planch & Lind., *Ficus* spp., *Weinmania* spp., and *Cecropia* spp.. Over 200 bird species have been observed. The forests provide one of the last safe habitats in the region for some mammals, e.g. howler monkeys, tapirs, and nosebears. Merenberg is frequented by scientists and students and it serves as a rich genetic resource for Colombia and other tropical highland areas.

Major road construction has been the cause of spontaneous migration into the Merenberg region, and now, after 50 years of sympathetic management, the forest is threatened with destruction unless management can modify the influence of the peasant farmers who, out of necessity, mine the capital of the area's resources.

To address this problem, the Foundation has initiated programmes of seed collection, and propagation of native and exotic species for use in reforestation, woodlots and agroforestry and silvipastoral systems. The Andean alder, *Alnus jorullensis* HBK., and the willow, *Salix humboldtiana* Willd., have already been successfully established for such systems and the alder has also served as an effective nurse crop for some primary hardwoods.

Despite its very limited size, only 350 ha, Merenberg has proved to be large enough for a rich community of plants and animals to perpetuate itself. It is the intention of the Foundation for the reserve to serve as a model conservation project, and to help to educate the local residents to recognise and realise the potential of the forest to raise their own standard of living.

### RESUMEN

La reserva forestal Merenberg está ubicada en la parte oriental-central de los Andes Colombianos. Se la encuentra entre 2,000 y 2,500 m de altitud snm. La precipitación es del orden de 2,000 mm anuales y la temperatura media de 15°C. El bosque se constituye de especies latifoliadas de la montañas dominado por *Quercus humboldtii* Bompl., *Billia columbiana* Planch & Lind., *Ficus* spp. y *Cecropia* spp. Se han observado más de 200 especies de aves. Los bosques proveen uno de los últimos medio-ambientes seguros para los mamíferos, por ejemplo, mono aullador, danta (tapir) y cosumbo. Científicos y estudiantes visitan con frecuencia a Merenberg la cual representa un recurso genético rico para Colombia y otras áreas tropicales altas.

La construcción de carreteras ha estimulado migración espontánea hasta la región de Merenberg, y aún después de 50 años de administración responsable, el bosque está en peligro de desaparición al menos de que la administración pueda modificar la influencia de los campesinos que por necesidad explotan el capital de los recursos de la región.

Para enfrentar este problema, la fundación ha iniciado programas de decolección de semillas y propagación de especies indígenas y exóticas para reforestación, leña, sistemas agro-forestales y silvo-pastorales. Se han establecido ya el aliso andino, *Alnus jorullensis* HBK., y sauce *Salix humboldtiana* Willd., con éxito para estos sistemas y el aliso ha servido como un árbol protector efectivo para las frondosas de primera calidad.

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A pesar de su extensión limitada, 350 ha, Merenberg se encuentra de un tamaño adecuado para la perpetuación de una comunidad rica de plantas y animales. La fundación quiere la reserva sirva como proyecto modelo de la conservación, y que ayudaría educar y asistir a la población local reconocer y realizar las posibilidades del bosque para mejorar su nivel de vida.

### Introduction

Colombia covers an area of 1,138,911 km<sup>2</sup>, the only South American country with Pacific and Caribbean coastlines. The landscape is diverse, dominated in the East by the central Andean mountain range, and in the southeast by the upper reaches of the Amazon basin (see Fig. 1). Ecosystems range from desert to tropical rainforest, and from palm fringed shorelines to snow covered volcanic peaks.



Fig. 1. Location of Merenberg



AERIAL PHOTOGRAPH  
OF THE  
MERENBERG REGION

Plate 1. Aerial photograph of  
the Merenberg Region, 1981.

Prior to the arrival of the Spanish colonists in the sixteenth century, the majority of the indigenous population lived in the Andean interior. The colonists began the process of large scale deforestation, which still annually claims 500,000 ha (Barborak and Glick, 1983). They generally saw the forest as unproductive and a potential threat to their cleared land. In the Spanish Colombian culture, deforestation is seen as the peasant's contribution to the historic and progressive work of colonisation.

In spite of this attitude, some groups are attempting to conserve and manage Colombia's remaining tropical forest. The Merenberg Foundation in southern Colombia illustrates the conflicts faced by such organisations.

### History of the Merenberg Region

The land now protected by the Merenberg Forest Reserve was first settled by a family of German immigrants in 1932. They homesteaded virgin forest land at an altitude of 2,300 m on the eastern slopes of the Cordilleras, clearing small pastures in areas not susceptible to erosion, leaving headwaters of streams with protective vegetation (Plate 1).

The family lived in isolation until the 1940s when construction of a road along one of Colombia's main transport routes, opened up the area to other settlers. At the same time, civil war encouraged spontaneous migration from the towns. For many refugees, the new highway offered access to new lands and a chance to leave behind the "violencia" (Alvarez, 1982). The first of these colonists were highway workers who located their houses up to 20 km ahead of the projected route. As in much of the central Andes, they relied on wood-cutting for their livelihood. Some of them sold the land they had cleared to other settlers, who planted small crops and grazed cattle. Throughout the region, pastures were established on the slopes and terraces above 2,000 m and crops were planted in the valleys.

### Pressures on Natural Resources

In the Merenberg region there are two migratory currents generated by an expanding population, insufficient land and the lack of employment. Some movement is seasonal, occurring when the local peasants, who have completed clearing and planting their land, migrate to the coffee regions in the Department of Cauca 100 km to the west. They work on coffee estates for several months, earning about 230 pesos (£1.80) a day, double the wage paid in the Merenberg region. Secondly, new settlers continue to flow into the Department of Huila, 200-400 km to the East, where road construction is opening up previously unsettled forest lands.

The people living adjacent to the Merenberg Reserve are the third generation of colonists, numbering about 600. The majority are subsistence farmers, but others survive by cutting and selling timber from the remaining native forests.

The average farm size was originally about 50 ha but inheritance has reduced this to about 12 ha. The most common crops are kidney beans, coffee beans, corn, bananas, and tuberous plants. Coffee beans, kidney beans and corn are grown as cash crops. Traditional methods of cultivation involve the clearing, burning and planting of approximately one ha blocks. Beans and corn are sown together. The former are grown for four months, the latter for six months. Typical yields are 350 and 400 kg per ha respectively (Alvarez, 1982).

Peasant timber-cutters usually contract their labour to landowners, who are required to obtain a woodcutting permit from INDERENA (Department of Environment) and are also obliged to reforest areas being cleared. However, few landowners observe this



Plate 2. Felled area suitable for replanting.

regulation and the lack of staff and funding prevents INDERENA from enforcing the law. Consequently, deforestation continues (Plate 2). Its impact was identified by a peasant farmer:

“As the rate of cutting increases, erosion and landslides become more frequent, causing our streams to dry up in the dry season and to flood in the wet.”

Timber is cut and sawn in the native forest before being carried out by mule or floated down the streams to the road and delivered at weekly intervals by truck to market. The most desired species are encenillo (*Weinmania* sp.), canelo (*Nectandra* sp.), chaquiro (*Ocotea* sp.) and cedro negro (*Juglans neotropica* Diels.). Wood is important in house construction, for furniture, as charcoal or directly as fuelwood, and for fence posts. Besides providing timber, the forest vegetation is an important source of medicine for the local residents.

#### Merenberg Forest Reserve

Merenberg Forest Reserve covers an area of about 350 ha, 150 ha of which is covered by primary and secondary forest, 100 ha is pasture of kikuyu grass (*Pennisetum clandestinum* Hochst.), 50 ha is reforested pasture, and the balance is principally exposed rock. The reserve lies between 2,000 and 2,500 m altitude, at a latitude of 76°10' W and longitude of 2°20' S and receives an average rainfall of 2,000 mm. The mean annual temperature is 15 °C. The minimum temperature never falls below 5 °C. The Merenberg region has two wet and two relatively dry seasons each year with the principal dry season between December and February and the lesser one between July and September. The soils are volcanic in origin.

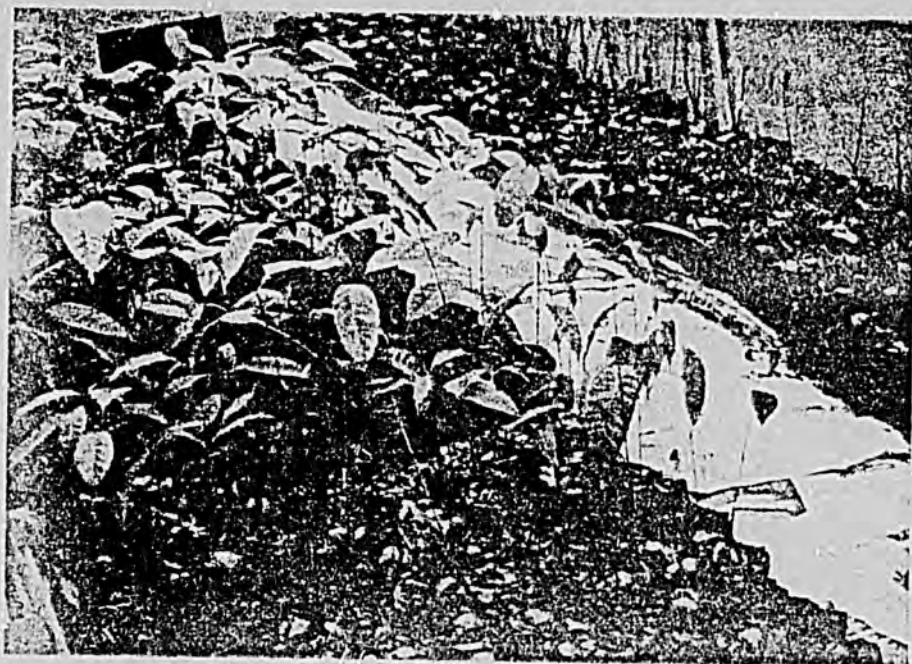


Plate 3. *Billia columbiana* seedlings.

The owners of Merenberg have kept the forests and pastures productive for fifty years without dramatic depreciation of the site. Each year the conflict intensifies for their land between the owners and the increasing number of settlers, some of whom have taken over part of the property. The Merenberg Foundation was established in 1981 to help protect the forest reserve and resolve the conflicts between the owners and local residents.

Merenberg Reserve is rich in both flora and fauna. To date, over 300 species of plant and 200 species of birds have been identified (Merenberg Flora and Fauna Inventory List). The forest-dwelling mammals, e.g. two-toed sloths (*Choloepus hoffmanni*), and the night monkey (*Aotus trivirgatus* subsp. *lemurinus*) can be observed at night. The agouti (*Dasiprocta fuliginosa*), black capped capuchin (*Cebus apella*), and the red howler monkey (*Alouatta seniculus*) can be observed during the day. The tapir (*Tapirus pinchacus*), crab-eating fox (*Cerdocyon thous*) can be observed both day and night. For many species, the Reserve is a last refuge in the face of widespread regional deforestation. Merenberg guards a wealth of genetic material for Colombia and the world, and remains as one of the few sites where Colombian Andean flora and fauna can be studied in their natural environment.

As well as conserving the native forests of the Reserve, work at Merenberg is addressing the problems of deforestation and appropriate reserve management. The Foundation has initiated programmes of seed collection, germination and propagation of native and exotic trees (see Plate 3). It intends to use them for the establishment of agroforestry plots, of wood lots for local community use, of buffer zones to protect native forest, to provide additional wildlife habitat and to reforest water catchments.

The trial plantations have been established on an adjacent farm acquired by the Foundation as a reforestation demonstration site. Reforesting began in 1981 and the

majority of stock is made up of the Andean alder (*Alnus jorullensis* HBK).<sup>\*</sup> This alder was the first species to be systematically field tested on foundation land. Although the alder does not occur naturally in the Merenberg region, it is native to many areas of the central and eastern sierras of the Colombian Andes with similar climates. The alder's rapid growth, straight bole, natural pruning, useful wood, and nitrogen-fixing capability make it an ideal species for plantation culture (Smit, 1971). Additionally, the alder's open canopy makes it a suitable species for planting in association with other tree, food or pasture crops in agro-silvicultural systems (Carlson, 1984). Initial stock came from central Colombia; the seeds were germinated in a state nursery and grown for four months. Seedlings of approximately four cm in height were transported in moss to the Merenberg nursery where they were planted in plastic containers. Containers were inoculated with crushed nodules from alder established in the nursery to ensure adequate nodulation with the nitrogen-fixing bacterium (*Frankia* sp.) which causes root nodulation in this genus. Seedlings were raised to a size of 20-75 cm (eight months after germination) before planting at the site (Carlson, 1984).

One trial of three ha comprises alder established as a nurse crop for slower growing primary forest species, such as oak (*Quercus humboldtii* Bonpl.), cedro negro (*Juglans neotropica*), cedro colorado (*Cedrela* sp.) and chestnut (*Pillia columbiana* Planch and Lind.). Both the alder and the primary species have grown vigorously since establishment. It is hoped that they will eventually serve as an on site conservation stand as many of these species are threatened by deforestation.

The second trial demonstrates the use of alder and *Salix humboldtiana* Willd. in the improvement of pasture areas. Both tree species were planted without fertilizer or intensive site preparation, the alder into pasture land, where its nitrogen-fixing capacity should benefit pasture growth, the willow along streams and on poorly drained sites to facilitate water drainage. Two years after establishment, the alder reached an average height of 6.2 m, indicative of its potential for fuelwood production (see Plate 4). The willow, although a slower grower, can be periodically pollarded to provide forage.

The Foundation realised from previous work that alder can become adequately established with kikuyu with only one weeding, although two are preferred. Its ability to tolerate weed competition is important as campesinos (peasant farmers) often do not follow recommended maintenance practices with small tree plantations (Carlson, 1984). It is intended to test the performance of other tree species on pasture land within the Reserve as was done with the Andean alder, with the aim to identify their positive features that would have potential for local reforestation and perhaps other highland areas of South and Central America (Carlson, 1984).

### Merenberg in the Social Context

The historical attitude of the peasants towards the Reserve is typified by their attempts to burn and clear the forest. Relations between Merenberg and the peasants have improved but can still be tense. The immediate problems of survival associated with low levels of agricultural productivity, scarcity of finance, lack of technical assistance, poor transport and unfavourable commercial systems cause the peasants to ignore the long term aims of the Foundation.

To date, the Foundation and Reserve have only been able to provide a small source of employment to the local population, e.g., planting trees, weeding, fencing, seed collecting, and catering for visitors (students and scientists). However, the Foundation is eager to expand the employment potential by increasing its reforestation, agroforestry,

<sup>\*</sup>*Alnus jorullensis* syn. *Alnus acuminata* O. Ktze.



Plate 4. Two-year-old *Alnus jorullensis* on Merenberg; height — 6.2 m.

rural extension and conservation programmes. The expansion of programmes will help to satisfy the aspirations of the peasants by providing employment opportunities. The hope of the peasants is that an organisation will help to change their economic status and raise their standard of living by bringing in outside technical and financial assistance. This can be accomplished through organisations such as the Merenberg Foundation which is gaining the confidence of local residents and achieving recognition by international agencies. The local population is already benefiting from financial support which the Foundation has received from the World Wildlife Fund and from Rotary International.

There is an increasing awareness by the peasants that the management objectives of the Reserve will be for the eventual benefit of all the residents. The managers of the Reserve now need to invest time in education effort, both in the schools and for the adult populations.

### Conclusion

As habitat destruction increases throughout Colombia, more and more species find refuge in the forests which remain. Relative to other conservation areas, Merenberg is small and situated where there are severe population pressures on the land; yet it has proved to be a viable and important ecological unit in which management objectives can be realised. Many of the large Colombian National Parks, e.g. Parque Puracé, cannot be managed nor protected due to the lack of financial support and organisation, resulting in severe resource degradation. Rather than hiring a police force to protect the Reserve, it is the policy of the foundation to employ and educate the local residents. The Merenberg forests and Foundation need the complete support of the local community to conserve the resources and promote wise land use. These objectives can be realised only if the community recognises the current and potential benefits to themselves of the Reserve's forests and the Foundation's programmes.

### Acknowledgement

I would like to thank Gunther Buch — creator of the Merenberg Foundation and caretaker of the Forests of Merenberg, Colombia; Paul Carlson for his perseverance and dedication to establish the new alder forest of Merenberg; and the many colleagues who help support Merenberg and its philosophies. I would also like to thank Peter Kanowski and Dr. Alex Law for editorial advice. The World Wildlife Fund, U.S. has been a principal contributor of funds for the Merenberg Foundation's programmes.

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