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The Habitat of Treetops in the Tropics

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Canopy Operation Permanent Access System (COPAS). The system of steel poles, ropes and cable railway gondolas developed by the 1996 Körber Prizewinners makes it possible to descend into the tops of giant tropical trees from above.

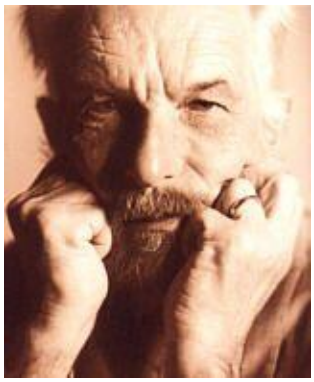
The upper areas of the rain forest are difficult to access, and therefore little researched.
(Photo: University Ulm)

Researching the tropical rainforest is no simple task. The high level of atmospheric humidity, dense vegetation, and stinging and poisonous animals make the work less than pleasant. While the cliché of the "green hell" may be somewhat exaggerated, it is still not entirely without basis. Investigating the treetop area which is home to most of the animal and plant species in the rainforest requires far greater effort and resources than research on the ground. This is confirmed by the significantly fewer research reports covering the ecosystem at dizzy heights. Accordingly, for many years now the botanist and tropical ecologist Professor Dr. Gerhard Gottsberger of the Department of Special Botany at the University of Ulm has been giving thought to how a team of scientists can work safely, effectively and without disturbing the ecosystem in the treetops at a height of up to 60 meters above the ground. This has given birth to COPAS – the Canopy Operation Permanent Access System, for the development of which the Körber Institute has awarded this year's prize of 1.25 million DM in support funding.

Gerhard Gottsberger
(Photo: Friedrun Reinhold)

Other researchers had already constructed systems for exploring the upper area of the rainforest, however in Gottsberger's eyes all of these have their weaknesses. The simplest approaches are, however, very restricted: observations with a telescope, collecting fallen plants and samples acquired by shooting or gassing. Working in the actual treetops is possible using ropes and alpine climbing techniques in conjunction with platforms. However this is a method calling for well-trained athletes, and is not suitable for all types of trees, as well as excluding the upper peripheral areas of the treetops. Nor are suspended bridges the optimal solution as they provide access only to parts of the treetops and also alter the ecosystem: they create unnatural connections between treetops making it possible, for example, for ants and other animals to cross over. Other researchers have created a giant platform placed on the canopy using an airship. While this can be rapidly installed and deployed flexibly at any desired location, it's still disturbs the world of the animals and plants, because its weight breaks off branches, among other things. A very promising system also developed in recent years makes use of construction cranes which lower a

working gondola suspended from the jib down into the treetop area from above. And if they have to travel along rails to cover a wider area, then a relatively broad swathe must be cut through the rainforest to lay these rails. Furthermore, cranes of this type can only be set up on even ground.



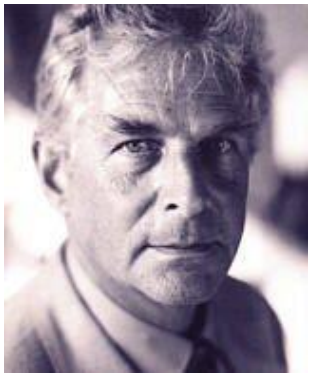
Ulrich Lüttge
(Photo: Friedrun Reinhold)

Bearing all of these disadvantages in mind, some eight years ago Gerhard Gottsberger and his technical colleague Joachim Döring set about devising a system which could be simply and safely used even by people unfamiliar with it and which had the least detrimental effect possible on the ecosystem in the treetops. "We were looking to develop a system to carry people of all types, i.e. men and women alike, students and professors, quite safely up into the treetops," recounts Gerhard Gottsberger. "Originally we had envisaged using trees projecting out above the canopy as pillars, but this did not prove viable. Then for a while we were planning to use a square area with a pillar at each corner, but eventually we rejected this as well."

Step-by-step, in minute detail and via numerous unsuitable variants, at the end of the day the optimal COPAS system now to be supported with the Körber Prize funding was to emerge. Its basic concept sees three steel poles being set up to project out above the rainforest canopy and form an equilateral triangle, with a system of tensioning ropes connecting them. On these ropes it is possible to move a work gondola over any point in the triangle from where it can then be lowered down into the treetop area. The advantages of this system are that two researchers can work safely in the gondola at the same time with no need for climbing acrobatics, the negative effect on the fauna and flora in the treetops is kept to a minimum and the three poles can be set up with only minimal intervention in the ecosystem even on uneven ground, on mountain slopes for example. There is no need to fell trees of any significant size to make room for the poles. In addition, the system can be extended as desired and at relatively low cost, by connecting additional triangles to the first and providing additional gondolas.

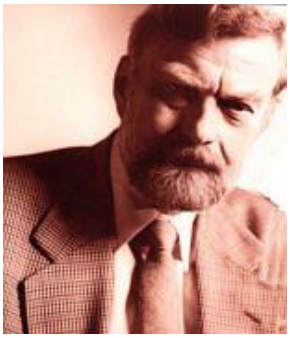
With COPAS – shown here in the form of a computer simulation – it will now be possible to research the previously unexplored world of the rainforest canopy.
(Photo: Herbert Grambihler)

Once the final design of the system was ready, Gottsberger and his team presented it to colleagues. It was very positively received by working groups from Germany, the Netherlands, Austria, and France. This rapidly developed into concrete interest in collaboration, with various teams sending suggestions for individual research projects. As a result, there are now six scientific working groups working together on the COPAS project.



Ulrich Linsemair
(Photo: Friedrun Reinhold)

The team led by Professor Dr. Karl F. Linsenmair at the Biocentre of the University of Würzburg specializes primarily in insects and vertebrates. Professor Dr. Bert Hölldobler's working group, likewise from the Biocentre of the University of Würzburg, will be addressing ants and the role they play in the treetop ecosystem. Professor Dr. Pierre Charles Dominique of the National Museum of Natural History in Brunoy, France is more interested in vertebrates. He and his colleagues want to undertake research primarily into monkeys and bats, and how these animals interact with the ecosystem, for example how seeds are distributed by monkeys. Professor Dr. Antoine Cleef and his working group from the Hugo de Vries Laboratory at the University of Amsterdam are more interested in botany and will be investigating the propagation and dissemination biology of specific plants. The team led by Professor Dr. Ulrich Lüttge of the Botany Institute of the Darmstadt's Polytechnic College also devotes its work to the world of plants and to those plants living on the branches of large trees – known as epiphytes –measuring the amounts on nutrients and carbon dioxide they consume, how photosynthesis operates with these plants and how the various substances are passed on within the ecosystem. Finally, the working group of Professor Gottsberger will be concentrating on various plants – blue-green algae, lichens, mosses, ferns and everything up to flowering plants – and will also be investigating interactions between animals and plants, and micro-climatic phenomena, for example humidity fluctuations.



Bert Hölldobler
(Photo: Friedrun Reinhold)

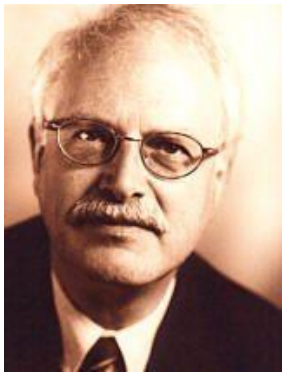
This interest in the tropical rainforest is shared by researchers and the public alike, and with good reason: up to 80 percent of all animal and plant species – most of which are still unidentified – live in this environment, according to biologists' most recent estimations. Zoologists have discovered 43 types of ant on a single tree – as many as are found in the whole of Great Britain – and here in Central Europe we find five to ten types of tree in a hectare of land. The equivalent figure in the rainforest was 307. This means that the rainforest harbors an inexhaustible potential of plants for possible medicinal or nutritional use. At the same time the tropical forests have an important climatic role to play; one third of primary biological production takes place there and they store 46 percent of the carbon held in terrestrial plants and animals. Accordingly, destruction of the forest releases 0.5 to 2 billion tonnes of carbon in the form of carbon dioxide every year, representing 15 to 20 percent of global emissions of this gas which exaggerates the greenhouse effect. The local climate is also severely compromised by felling over a wide area, as the rain forests generate three quarters of their own precipitation themselves, by means of evaporation. Other threats associated with clearance are ground erosion, desertification, and flooding.

Nevertheless, the destruction of the tropical forests continues at breakneck pace: more than 40 percent of the original forest areas have already been cleared. Accordingly, research into this – the world's largest reservoir of species, its climate regulator and a unique environment – is an urgent necessity, not least to awaken politicians and industry to the fact that this environment is something other than

simply a source of tropical hardwood, as it represents a unique ecosystem which must be retained as the future source of new healing and crop plants, as well as a tourist attraction.

Pierre Charles-Dominique
(Photo: Friedrun Reinhold)

COPAS is designed to make an important contribution in this respect. Not least thanks to the support provided in the form of the Körber Prize funding, work on the system at its estimated cost of around one million DM – plus 250,000 DM for the research program – can now press on apace. The researchers are planning to set up COPAS in French Guiana in the immediate vicinity of the existing "Les Nourages" research station, some 115 kilometers north-west of the capital, Cayenne. The final decision on the location will be taken within the context of a further research trip in October of this year. On this occasion, there will probably be engineers from a cable-railway company accompanying the party to organize the construction of the system and the associated research station. Later this year, there will be sand and gravel dredged from the Arataye river for the construction of the foundations, with water turbines being installed for the power supply. Then next year, it might be possible to ship the individual components of the COPAS system over to South America for transportation by lorry and canoe to their final destination. This will lead on to the construction of the central building for the associated research station and finally setting up the cable-railway system itself. If everything goes to plan, COPAS could be ready for operation by the end of 1997.



Antoine Cleef
(Photo: Friedrun Reinhold)

The first research projects planned could then get underway. Three of these are devoted to epiphytes and the communities in which they live in the canopy. One project is specifically to investigate the role of ants with reference to the variety of species in the rainforest. The fifth research project is to investigate the extent to which animals take an active part in how the vegetation is structured, in the role of 'gardeners' so to speak. The topic for the sixth project is how the rainforest is changed naturally by the proliferation, regeneration, and interaction of plants and animals over the course of time. The last is devoted to arboviruses – sources of disease which multiply in insects or other articulate animals and in some cases are passed on to humans, where they can trigger dangerous illnesses. The initial results of these COPAS-assisted projects are expected to be available in the course of 1998.

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