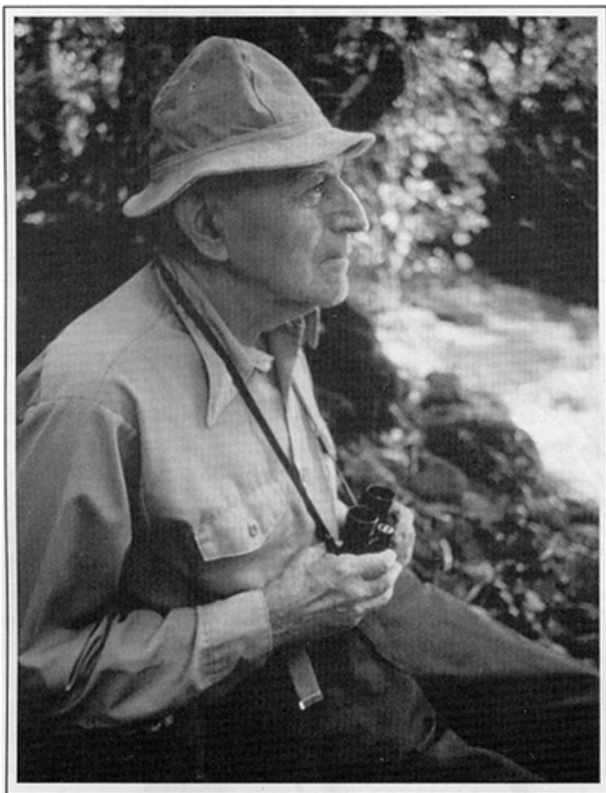


A NATURALIST IN THE RAINFOREST
A Portrait of Alexander Skutch



STUDY GUIDE

By Paul Feyling

A Bullfrog Films Release

ACKNOWLEDGEMENTS

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With thanks to James E. Carmack, Jr.
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Bicolored Antbird observes Alexander Skutch

STUDY GUIDE

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INTRODUCTION

As Alexander Skutch states at the beginning of this film, he considers the tropical rainforest "the highest expression of the creative movement on this planet". For more than sixty years Skutch has been unravelling the secrets of the tropical rainforest and contributing to our growing knowledge of this magnificent ecosystem. His story provides insights on many levels, the methods of field research, the interactions of plants and animals in this most complex of ecosystems, and the urgency to preserve its remaining remnants. But throughout, Skutch's story is an example of the passionate commitment and curiosity that drives a pioneer naturalist. Skutch has written "As much as I have loved and sought truth, I have loved and sought beauty even more." And in the rainforest he has discovered not only the visual beauty of hummingbirds and flowers and foliage, but also the essential nature, the hidden beauty of relationships and adaptations that make this the most exuberant expression of life on earth. As the rainforest has inspired him, so too it can inspire us to do what we can to understand and preserve this vanishing wilderness.

SYNOPSIS

Alexander Skutch first came to Central America in the 1920's to do botanical research, but he was soon captivated by the colorful birds and became curious about their daily habits. Looking up some questions that he had, he found that very little had been discovered about the lives of tropical birds.

He decided that was such an obvious gap in our scientific knowledge that someone ought to try to fill it, and he resolved to do so himself.

In those days most ornithologists were concerned with finding and naming new species and supported their field studies by collecting bird skins for museums. But Skutch wanted to study the behavior of the living bird and wouldn't consider shooting the birds to support his studies. His background in botany provided him with a solution: he would collect plants for museums for his income.

Full of enthusiasm, Skutch set off into the rainforest to study its birds, but he soon discovered this was a very frustrating endeavor. Not only were the secrets of their lives and their nests well hidden in the dense foliage, but when nests were finally found, the eggs or nestlings were almost always destroyed before the nesting had been completed. Eventually his records revealed that up to four out of five nests in the rainforest are lost, usually to predators.

If so few of the nests are successful, Skutch surmised that the adults must live a long time otherwise the populations would decline. Eventually this proved to be correct. His own observations over the years have recently been confirmed by banded studies that show small birds living as long as twenty years in the rainforest. Large birds such as parrots have been known to live in captivity for nearly a hundred years.

The long lives of tropical birds have allowed them to develop complex patterns of behavior. During the mating season the males of some tropical birds, such as the Orange Collared Manakin, gather in courtship assemblies, or leks. Here each male displays on his own "court" by jumping back and forth and making a loud snapping noise. The males respect each other's courts and compete in a ritualized manner that avoids direct conflict. The females visit the assembly and select the male they will mate with. As a rule, in bird species that utilize courtship assemblies, the females alone carry out the nesting activities. *(See the sidebar for more of the story about complex courtship behavior in tropical birds)*

COMPLEX COURTSHIP DISPLAYS

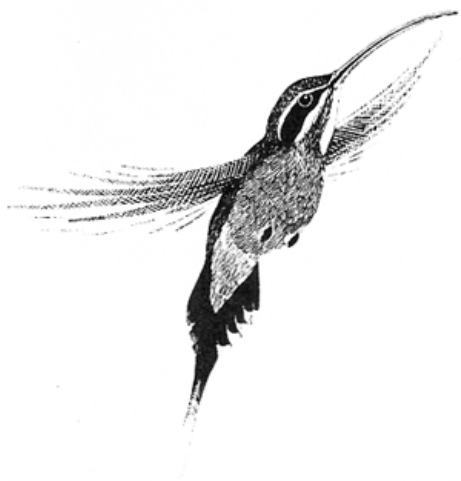
It is not only their long lives that have led tropical birds to develop complex courtship behavior. Their feeding habits have also had a lot to do with it. Generally the tropical birds with the most complex behavior and the most colorful plumage are fruit eating or nectar sipping birds. Fruits and flowers are easier to feed on than insects and other prey that can escape. Therefore fruit eating birds don't have to be as wary and camouflaged and also have more time for courtship behavior. Since the least activity around the nest is less apt to attract predators, birds with only one parent bringing food to the nest can have an advantage. All the more reason for the males to occupy themselves with complex courtship displays. The same highly developed color eyesight that can distinguish fruits and flowers has also led the females to select the most colorful males. Therefore we see the consequence of fruit or nectar feeding among tropical birds in their colorful plumage and bizarre behavior.

Feeding habits are the key to understanding much of the behavior of tropical birds and Skutch's background in botany was definitely to his advantage. Not only could he identify the fruits and flowers the birds were feeding on, but his knowledge of plants gave him an understanding of their habitats and an ecological perspective that was ahead of its time.

In the past much had been made of the fierce competition for survival in the rainforest, but Skutch found that the great variety of species in the rainforest can coexist peacefully because they take different foods.

The Long-tailed Hermit Hummingbird, for example, has a curved bill to feed on flowers shaped more or less like its bill. It follows a route around the forest feeding on its favorite flowers in a pattern that is called the "trapline system". Another hummingbird, the Flame-throated, has a short straight bill to feed on its favorite flowers which are usually close together on a few bushes which it pollinates and defends as its feeding territory. Nearby could be another hummingbird that avoids competition by feeding on its own favorite flowers and never challenging the Flame-throated's territory. The result is that the rainforest has an incredible number of niches where species can coexist peacefully. (See sidebar on diversity and co-evolution.) Being resident year-round in the same area, the birds have more time to establish their territories so that tropical birds clash less often and are generally more peaceful than northern birds.

Nevertheless, their nesting remains extremely precarious. The birds have evolved complex nesting strategies to minimize predation and loss. Skutch has found that birds will build their nests out of reach of predators by hanging them over a rushing torrent, or hiding their nest inside a termite nest. They will also build their nest in a thorny bush or even next to a wasp's nest for the protection the wasps will offer.



Long-tailed Hermit Hummingbird

DIVERSITY AND CO-EVOLUTION

The tremendous diversity of species in the tropical rainforest is one of its most celebrated characteristics. There may be up to a hundred species of trees, for example, on an acre whereas in temperate forests a dozen species per acre would be above average. There are several reasons why this great diversity has evolved. One reason is the much older age of tropical forests, which have been spared the advance of glaciers during the ice age that swept through temperate regions, wiping out everything. Another reason is that the high humidity and the lack of freezing temperatures in the tropics allow more species to flourish. Without the cold winters that encourage migration, species are generally resident in the same area all year round, therefore they have less contact with other populations and tend to develop their own characteristics. So a great deal of speciation has occurred leading to specialization and a multitude of niches. One of the ways this has evolved is through co-evolution. The plants and the animals that feed on them have co-evolved so that they depend on each other for survival. By pollinating their flowers or spreading their seeds, the animals that feed on the plants are selecting the plants that they need for survival. Over time the flowers that are successfully pollinated will more closely fit the shape that its hummingbirds need, and the bills of the hummingbirds in turn will also evolve to fit the flowers they feed on. Co-evolution has also influenced the dispersal pattern of plant species in the rain forest. Plants evolve fruits and flowers that appeal to animals that pollinate on the "trapline system", for example, or to animals that can spread the seeds far from the mother plant, such as birds and mammals. And the animals evolve to take advantage of specific fruits and flowers. It all adds up to a tremendous number of niches and the dazzling diversity that we associate with the rainforest.

It may seem surprising that in this lush habitat most birds lay fewer eggs in their nests than their northern cousins. But again this is an adaptation to the high level of predation and the fact that as many as 80% of the nests fail. By not laying "all their eggs in one basket" they have less to lose, have spent less of their time and energy and can more readily try again.

The danger that young birds face in the rainforest has led some species, like the Golden-naped Woodpecker, to stay together as a family for the whole first year after the young are able to leave the nest. The young return and sleep together with their parents in the nest hole until their mother lays eggs the following year.

Discoveries like these were Skutch's rewards for his patient long watches. In 1935 he was studying the Brown Jay in Guatemala when he made a momentous discovery. While he was watching their nest he noticed that Brown Jays other than the parents were coming to feed the nestlings. This was the first instance of cooperative breeding that had ever been recorded. Later it was found to exist in all parts of the world, although more commonly in the tropics. Cooperative breeding has led to conflicting interpretations and much controversy among biologists. (See sidebar on cooperative breeding.)



Golden-naped Woodpecker

COOPERATIVE BREEDING

Cooperative breeding, or helpers at the nest, is controversial because it seems to contradict one of the favorite theories of modern evolutionary biology: the theory of maximum reproduction, which holds that each individual strives to perpetuate its own genes as much as possible. A helper at the nest is usually forgoing its own reproduction while it assists another individual. This would seem to be contrary to its own best interest according to the theory of maximum reproduction. To overcome this contradiction, the theory has also been interpreted more broadly as "kin selection". In cooperative breeding the individual bird is often helping to feed its younger siblings, therefore helping the family genes to be perpetuated. But there are many instances of cooperative breeding in which the helpers are not siblings but members of a larger group, so some biologists have postulated a "group selection" theory, which others vigorously oppose. But Skutch believes that while there are many reasons for cooperative breeding, basically it is mutually beneficial to the helpers and the parents. The helpers may gain experience, for example, while they help the parents by feeding the young and protecting the nest. In some birds cooperative breeding is an expression of their highly social nature, and in others it has arisen because of habitat saturation with more adults than are needed as breeding pairs. Skutch sees birds not as feelingless mechanisms for the multiplication of genes but sentient creatures concerned for their own safety and comfort. Naturally those who make the right decisions survive, so he doesn't see a conflict with the main thrust of evolutionary theory. Skutch also believes that cooperative breeding is another expression of the tendency in nature for ever more complex and harmonious patterns to emerge.

In 1937, after nine years of studying birds all around Central America, Skutch began the first study that had ever been done on the most famous and magnificent of tropical American birds, the Quetzal. Moving to the highlands of Costa Rica, he found a cottage that he could use as a base and began his long search for the Quetzal. There was much glamour and mystery surrounding the Quetzal. It was the subject of many legends and myths and had been revered by the ancient Mayan Indians, who used its feathers in the headdresses of their rulers.

The cloud forest habitats of the Quetzal are unusually wet and often cold and Skutch had to endure much discomfort and isolation as he waited for a glimpse of this beautiful bird. These cloud forests support a magnificent and lush vegetation, characterized by the epiphytes, including mosses, bromeliads, and ferns that cling to the trees in dense colonies that create small ecosystems of their own.

During the worst of the cold, wet storms, Skutch wondered if the Quetzals could still be in the area or if they had migrated to lower elevations.

Exploring his surroundings he found that nearby were the twin craters of Volcan Poas: one bubbling and active, spewing forth steam and a sulphurous smell; the other a much older and inactive crater, peaceful and blue, its banks covered in mature green forest.

After nine months of waiting, Skutch began to hear the mellow calls of the Quetzal. Then finally his dreams came true: he found a nest in a tall rotten trunk at the edge of the forest. By long continued watches he learned that the male and female took turns incubating the eggs. Away from the nest he noticed that they were feeding largely on fruits of the Laurel trees, wild relatives of the Avocado, which they usually plucked off on the wing. Later the male and female took nearly equal part in the feeding and brooding of the nestlings, but in a later nest the female tired and the male alone continued until the young left the nest.

Skutch's studies of the Quetzal have remained among his most treasured memories. The long, cold and wet watches that he



Quetzal

endured were amply repaid with intimate contacts with such a magnificent creature that the memory remains bright and vivid to this day.

In the years that have passed since Skutch completed his studies of the Quetzal, its cloud forest habitats have been reduced to a fraction of their original expanse. Costa Rica has preserved portions of this threatened habitat in reserves and national parks. But new studies are revealing what Skutch suspected, that during the stormiest months, the Quetzals leave the cloud forest and migrate to lower elevations where they find not only better weather, but the ripening fruit of other varieties of their favorite Laurel trees. This means that larger expanses of forest will have to be set aside to insure the survival of the Quetzal and many other species.

As plant ecologist Sharon Kinsman points out, a park or a reserve can become a "pocket handkerchief" of habitat, surrounded by deforested land, if steps are not taken to protect the land that adjoins a reserve.

Forest ecologist Milton Lieberman is among the many scientists who have intensified their studies of the rainforest in recent years. One of the things he is studying is evapotranspiration, the movement of water vapor out of the forest and into the air. This is important because the forest itself controls its own climate, and when you remove the trees, the rain often dries up and the land becomes a desert.

The clearing of rainforest for agricultural purposes gives poor results for another reason. Most of the nutrients are bound up in the vegetation and when that is removed, little is left.

Costa Ricans are among the best educated and most conservation minded people in Latin America, but they also face an enormous challenge, because their country has one of the region's highest rates of deforestation. The need for exports and cash crops has denuded much of the countryside.

Throughout the world the demands of a population growing in size and needs are upsetting the balance between nature and humanity.

Skutch believes that what human society most lacks is moderation, especially moderation in our demands on nature. He would like to see a return to the ancient attitude of reverence for nature and the land. As he concludes, "We must regard it as something holy."

RESEARCH METHODS

In his scientific studies Skutch was following the age-old method of watching and recording. With systematic observations of the birds and careful notetaking he gradually compiled their life histories. Unlike many modern scientists who try to isolate a phenomenon and prove or disprove a hypothesis, Skutch's approach was to observe the birds in their natural habitats with no outside interference and no preconceived ideas about what he was looking for. As a result he discovered much that was new to science, including cooperative breeding. His reluctance to interfere in their lives or manipulate their behavior in any way caused him to forgo catching and banding the birds. In order to keep track of individual birds he had to be aware of subtle differences in the markings on the plumage or bills of the birds. His discovery of cooperative breeding, for example, was possible because he kept track of the differences in markings on the bills of the Brown Jays that came to a nest and found that the parents had five helpers coming regularly to feed the nestlings.

PRE-SCREENING ACTIVITIES

- ❖ Students should be oriented to Central America by seeing a map of the region and its relationship to North America. Maps which show bird migration patterns could point out the connection between Northern bird species and their wintering habitats in Central and South America. One amazing accomplishment is the migration of the Ruby-throated Hummingbird which travels from as far as Canada to Mexico and Central America, crossing the Gulf of Mexico without being able to stop or feed for hundreds of miles. Once Skutch identified a Ruby-throated Hummingbird that stopped briefly at his farm.
- ❖ A discussion could be initiated about what image the students have of the rainforest...to be continued later after the screening. Is it a dense, impenetrable jungle? Is it a violent, dangerous habitat with constant strife among the creatures? Or a peaceful Garden of Eden?

POST-SCREENING ACTIVITIES

- ❖ The discussion could be continued about how the rainforest differs from some of our preconceptions. Did any students notice whether the interior of the rainforest seemed impenetrable? Would you call the rainforest a violent or a peaceful ecosystem? If there was evidence that there are a great number of predators, were there also indications that there is also a great deal of harmony and cooperation, and behavior aimed at avoiding competition and predation. Examples?
- ❖ The great amount of specialization in the rainforest, does it have any parallels with modern society. Does the role of competition in the rainforest have any parallel with competition in our society? For jobs, mates, position? Does it suggest anything about our own efforts to find a role, a career? What parallels can the students see?

❖ Specialization has been very important in the sciences as well as in medicine in recent decades and taught us a tremendous amount about the details of the workings of nature and disease and our own bodies. Lately however the value of the holistic approach, looking at the whole system, whole organisms, the whole ecosystem has been recognized as more and more important. Now that we know how the parts work, we want to know how it all works together. It is interesting that Skutch as a pioneer naturalist and also the two modern scientists in the film all have this wider focus. Sharon Kinsman is a plant ecologist, studying relationships between plants and animals, Milton Lieberman is a forest ecologist, studying how the forest functions as an organism. The students could discuss the respective contributions of specialists and generalists and examples of what might be of special value in the future.

❖ Students could discuss or report on issues about the conservation of the rainforest.

- ◆ The extent of the rainforest remaining worldwide as shown on maps.
- ◆ The need for wide expanses of rainforest for species that migrate altitudinally.
- ◆ The value of rainforest as wintering habitat for northern species.
- ◆ The loss of rainforest for short-term agriculture or cattle raising operations.
- ◆ The economic pressure that developed countries place on the rainforest.
- ◆ The value of rainforest as a gene pool for medicines and agriculture.
- ◆ The value of the rainforest for ecotourism.
- ◆ The value of the rainforest for its own sake, to preserve it because it has its own value that doesn't have to be measured in terms of its utility to human society

GLOSSARY OF TERMS FROM FILM AND STUDY GUIDE

Altitudinal migration - The seasonal movement of species, such as the Quetzal, up and down a mountainside.

Brooding - Sitting on or incubating the eggs.

Co-evolution - The evolution in two or more species of characteristics that adapt them to each other

Cooperative breeding - When birds other than the parents assist in the nesting process.

Courtship assembly (or lek) - A gathering of birds for the choosing of mates. Usually males gather and display their qualities and the females visit and choose their mates.

Ecological niche - A habitat supplying the factors necessary for the survival of an organism or a species.

Ecology - The interrelationships of organisms and their environment.

Ecosystem - a community in nature that functions as a unit.

Epiphytes - Plants that grow on other plants and get their nourishment through air and rain.

Evapotranspiration - The movement of water vapor out of the forest and into the air.

Kin selection - The theory that helpers at the nest who are related are helping perpetuate their family genes.

Lek - See courtship assembly.

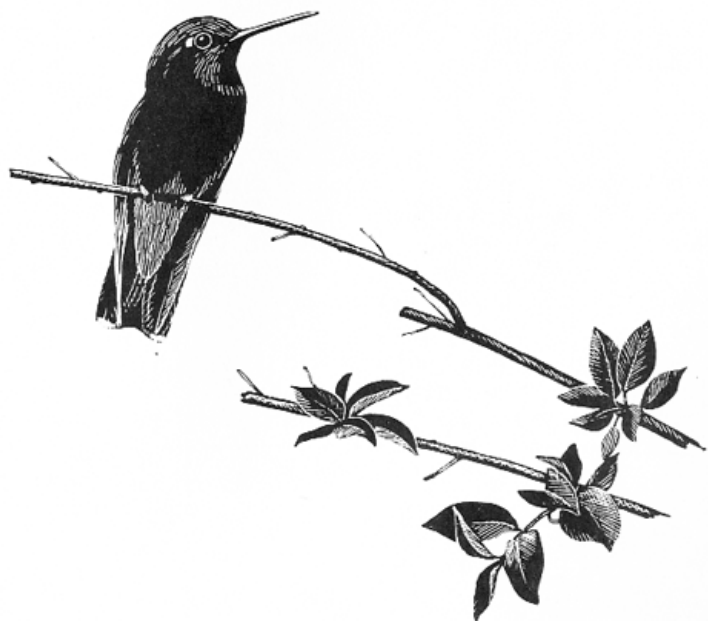
Ornithologist - A scientist who studies birds.

Saturated - Filled to capacity.

Speciation - The process of evolving new species.

Trapline system - The feeding pattern of birds that follow a route or a circuit visiting their widely scattered food plants.

Tropical rainforest - While the term "rainforest" is often used broadly to refer to many types of wet, tropical forest including cloud forest, technically it refers to hot, wet, lowland tropical forest with a rainfall exceeding about 140 inches annually - your classical Amazon jungle.



Violet-headed hummingbird

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Related Bullfrog Films

- ❖ A Celebration of Birds with Roger Tory Peterson
54 minutes, grades 6-12
A delightful portrait of the man whose passion for birds has enabled millions to enjoy nature.

- ❖ The Rainforest
10 minutes, grades 6-12
A short primer on the water and nutrient cycle of the tropical rainforest.

- ❖ Songbird Story
13 minutes, grades K-6
In a mixture of live action and animation, two young children learn why it is that the population of songbirds is diminishing.

- ❖ A Walk in the Rainforest
11 minutes, grades K-4
A boy in Belize takes young viewers on a guided tour of his rainforest pointing out the rich diversity of life and the necessity of saving such important places.

- ❖ Where the Heron Finds its Home
46 minutes, grades 7-12
Heron thrives in healthy wetlands. Biologists can tell the state of a given wetland by the health of its heron population.

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