

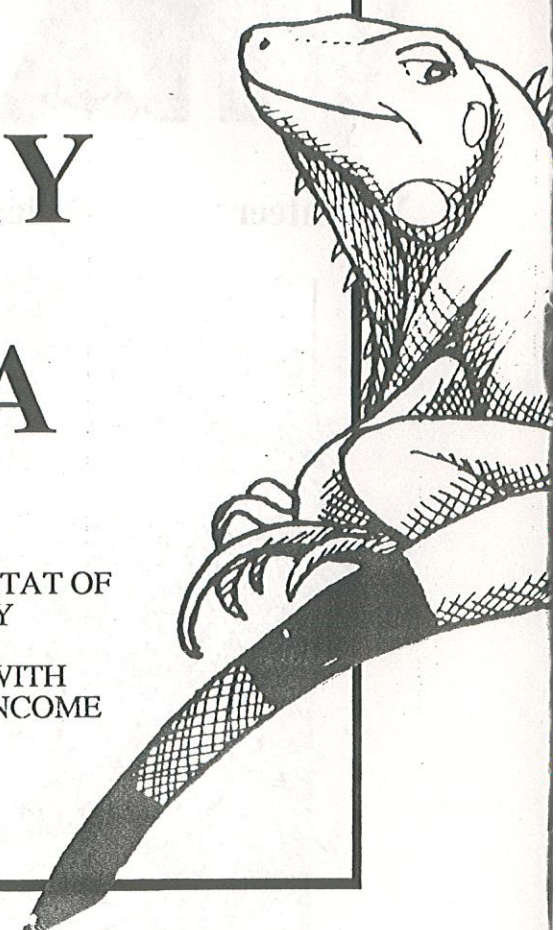


THE DAY OF THE IGUANA

PROGRAM AIMS TO RESTORE HABITAT OF
THIS DWINDLING SPECIES BY
COMBINING INNOVATIVE
AGROFORESTRY TECHNIQUES WITH
FARMER'S NEED FOR FOOD AND INCOME

by Carol Stoney

Drawings by Deirdre Hyde

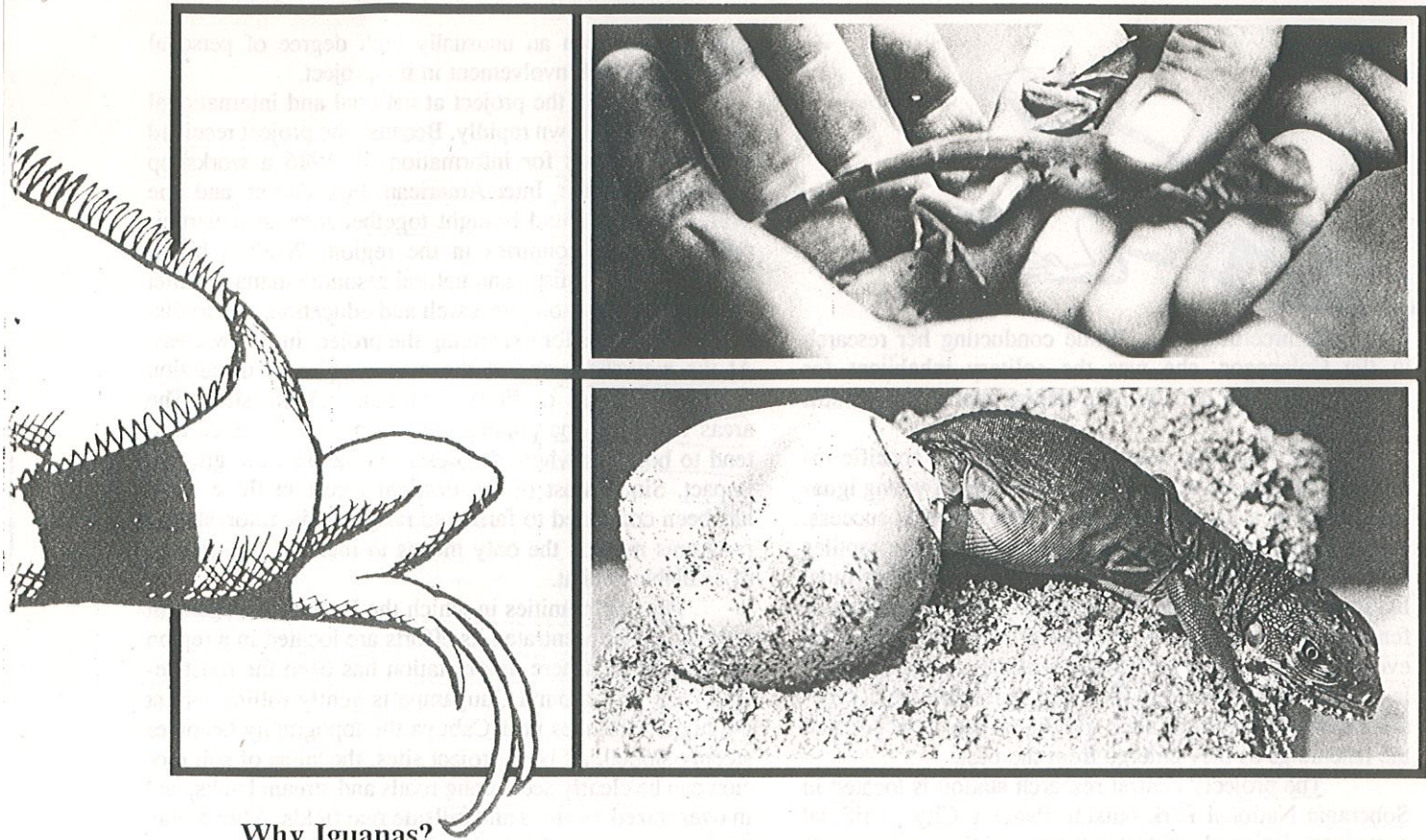


Thirty years ago Don Diego Gonzalez was a young farmer and cattle rancher in the village of Chupampa on the Azuero Peninsula in Panama. Raising cattle is a popular occupation in Panama, although much of the land is not suited for intensive grazing or cropping. The North American beef market makes it profitable, even for farmers with small land holdings. Like his neighbors, Diego Gonzalez cut down all the trees on his land to clear pastures and plant crops.

Once the tropical forest is cleared, however, the soil rapidly loses fertility and without trees to protect it, becomes highly vulnerable to erosion. Many farmers abandon land that has become unproductive, simply clearing new fields out of the remaining forest. As forest areas dwindle, many species of wildlife disappear as well. When Diego Gonzalez saw this happening to his own farm, he began changing his farming methods, providing space for trees and wildlife alongside the livestock and crops. He especially wanted the green iguanas to return. He protected and encouraged seedlings that came up in his fields, and he planted some trees that he particularly liked for their fruits, wood, or even their flowers. Once he traveled for several days to bring back seeds of the *Cabimo* tree that didn't grow in Chupampa.

Gradually a strip of forest grew up along the creek bed that runs through his property and a large, shady grove of trees surrounded the house. Diego Gonzalez occasionally harvests one of the tall *Cabimos* for its aromatic lumber, as well as fruits, fenceposts, and firewood from other species growing on his farm. He still raises cattle, but the livestock graze between clumps of trees and shrubs dotting the pastures. Because he allows no hunting on his land, his farm has become a local wildlife refuge, particularly for the green iguana. From their kitchen the Gonzalezes can watch the iguanas feeding in the trees. Nowadays they are usually joined by several biology students who have come from as far as Honduras, Guatemala, and Costa Rica. These students observe the growth and behavior of a population of iguanas that were raised in captivity and released on Gonzalez' farm by the Iguana Management Project (IMP).

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Why Iguanas?

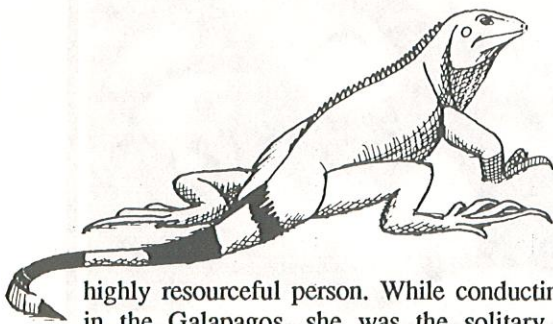
Diego Gonzalez was first approached in 1985 by the Iguana Management Project, and asked if his farm could be used as a research and demonstration site for this unusual experiment. The Iguana Management Project is part of an effort by the Smithsonian Tropical Research Institute to come up with innovative ways to conserve wildlife and forests in Panama while improving the lives of rural people. Research and education activities of the Iguana Management Project are supported by funding from the W. Alton Jones Foundation, the James Smithson Society, the International Foundation, the Inter-American Foundation, and the World Wildlife Fund.

Iguanas are a traditional source of meat in Panama, and their eggs are considered a delicacy and an aphrodisiac. They have become even more highly valued now that the animals are starting to become extinct in many parts of the country. In addition to the pressures from hunters, egg collectors, and wild predators, the green iguana's habitat is being steadily destroyed as large areas of forests are cleared by farmers and cattle ranchers. Iguanas spend their lives in the tops of trees and feed on the leaves, flowers, and fruits of many different species. Without the forest they are unable to survive.

The purpose of the Iguana Management Project is to help rural Panamanians raise iguanas as semi-domesticated livestock, which they can harvest as either a source of food or income. The iguanas are hatched and raised in enclosures until they are large enough to survive on their own. They are then released into small patches of remnant forest such as the one on the Gonzalez farm. They can be branded just like cattle to mark ownership. An adult iguana can be harvested after three years, providing about the same amount of meat as a large chicken. Because green iguanas are found throughout the area from Mexico south to Paraguay, and similar species live in parts of Africa and Asia, the research program promises widespread benefits to both the lizards and the farmers in these areas.

Program Studies Breeding Habits

Before any iguanas could be released, however, the project's first task was to learn how to breed and raise them in captivity. Many scientists did not believe that it could be done. Dr. Dagmar Werner, who is the principal investigator and project manager, began by trying to create enclosed research environments that simulate as closely as possible the conditions that a wild iguana would choose for breeding and nesting. Dr. Werner, a zoologist, had already spent seven years in the Galapagos Islands studying iguanas. She is also a



highly resourceful person. While conducting her research in the Galapagos, she was the solitary inhabitant for months at a time of a remote desert island with a still active volcano.

Dr. Werner's unique insight into the specific requirements for captive breeding and raising of young iguanas has been a crucial element of the project's success. The key to high survival rates is to protect the reptiles during the egg and hatchling stages, when they are most likely to fall prey to larger animals. Often a number of females will select the same nesting site, returning there every year. Normally the female will dig a nest, and then leave 30-40 eggs buried in the loose soil. In the wild, predators easily locate these sites and dig up the eggs, or catch the hatchlings as they emerge from the nest.

The projects' central research station is located in Soberania National Park outside Panama City. Artificial nests were designed and tested there, and they have proven highly acceptable, for the purposes of both the female iguanas and the research staff. By observing the habits of nesting iguanas and their choice of nesting site, it was possible to deduce that a desirable nest should have solid walls, a roof, and an entrance tunnel. The use of artificial nests allows the project to keep track of which eggs were laid by each female. Furthermore, the roof of the artificial nests can be lifted, so that the eggs can be removed and placed in styrofoam coolers, which serve as incubators.

Research carried out by the project has shown that temperature and humidity are important factors in hatching success, thus the incubator allows these conditions to be easily monitored and controlled. So far the results from these innovations have exceeded everyone's wildest dreams. This year 5,300 iguanas were hatched at the research station. Eggs were hatched from an incubator in the village of Chupampa for the first time this year as well. Approximately 90 percent of incubated eggs hatch, as compared with less than 50 percent of the eggs laid in wild nests. Since the release program was begun in 1984, a total of 4,300 iguanas have been reintroduced into areas where the species had almost disappeared. Follow-up counts at the release sites show survivorship is increased twenty-fold. Even when iguanas are raised for food, the management techniques promise to stabilize the population over the long term (See box).

Much of the success of the release program can be attributed to the environmental education activities that have been ongoing in the two rural communities with which the project is working. The response in these com-

munities has been an unusually high degree of personal commitment and involvement in the project.

Interest in the project at national and international levels has also grown rapidly. Because the project received so many requests for information, in 1986 a workshop sponsored by the Inter-American Foundation and the World Wildlife Fund brought together interested participants from ten countries in the region. Wildlife biologists, conservationists, and natural resource managers met to observe the ongoing research and education, and to discuss possibilities for expanding the project into new areas. At the workshop, one of the major topics of discussion was the problem of finding suitable release sites. The areas where iguana populations are most threatened also tend to be areas where deforestation has had the greatest impact. Since most of the original forest in these areas has been converted to farm and range lands, reforestation programs may be the only means to increase the amount of available habitat.

The communities in which the Iguana Management Project has concentrated its efforts are located in a region of the country where deforestation has been the most severe. The land around Chupampa is gently rolling, but at the higher altitudes near Cabuya the topography becomes steeply sloped. At both project sites, the signs of soil erosion can be clearly seen along roads and stream banks, and in overgrazed pastures and hillside rice fields. After a rain, topsoil is washed down deep gullies that carve up even relatively flat terrain. In addition to the problem of increasing the amount of habitat available for iguana release sites, there is also a need for reforestation to restore and protect degraded soils. In Cabuya the cooperative has planted rows of pines along the ridgetops, but because the trees were not planted on the contour, they have only a minimal effect on soil erosion.

Most of the reforestation efforts that have taken place in Panama have emphasized fast growing species such as pine, teak, and eucalyptus, many of which have been introduced from other parts of the world. So far there have been few attempts at propagating the numerous native trees that make up the green iguana's natural habitat. The apparent lack of interest in the indigenous species is due to the fact that it is simply much easier to establish and manage single-species plantations of trees about which a great deal is already known, than it is to try to recreate a complex tropical forest ecosystem. The IMP has already identified over 60 species of native plants that play some role in the iguana's feeding, resting, and defensive behavior—but the iguanas seem to have little or no use for the more widely used introduced tree species. They require a fairly high degree of plant diversity, which cannot be provided by an exotic monoculture such as a eucalyptus plantation.

New Forestry Approaches Needed

Since it was clear that standard approaches to reforestation in Panama would not be appropriate for iguana

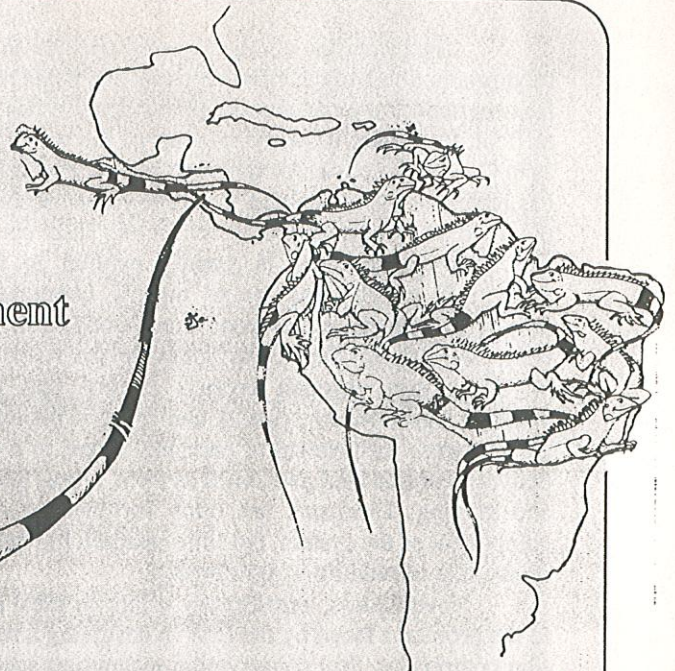
management, various other strategies were discussed. One such idea was the possibility of creating village wildlife preserves that could be cooperatively protected and managed. Although the IMP is working with a cooperative in the village of Cabuya de Anton, most communities in Panama do not have any experience with communal land ownership or management. Land in Panama is typically owned and cultivated by individuals or families. For the project to be successful over the long term, the trees would have to be planted on these farms and cattle ranches. Furthermore, over-exploited pastures and fragile upland farming areas are the sites most in need of soil conserving reforestation.

On the other hand, the rural people the IMP is trying to help are not wealthy, but rather are mostly owners of small to medium-size holdings. Many of these farmers cannot afford to tie up a large portion of the land in long-term investments like forestry. Often the only trees found on these farms were originally placed in the ground as fenceposts for barbed wire. The newly cut fenceposts take root in the moist soil and soon sprout branches, forming living fence rows along the borders of the fields. These fence rows are allowed to go on living, because they often serve other purposes as well, providing fuelwood, fruits, and fodder, without taking up much of the farmer's land.

In developing a reforestation component for the IMP, several key issues had to be carefully considered. First the trees should be planted in such a way as to help conserve soil as well as wildlife. Second, the choice of species was very important. The trees should be native species that were known to be used by iguanas, but they also must be species that farmers would want to plant. Finally, the areas to be reforested must be sufficiently large to maintain an iguana population, but they should be small enough that they would not take too much pasture or crop land out of production.

Iguana

Biology and Management



The green iguana (*Iguana iguana*) is a species of reptile which lives only in Latin America. Its distribution extends from Northern Mexico to Brazil and Paraguay. Management of iguanas as a type of semi-domesticated livestock is a new approach attempting to reintroduce iguana populations in areas where they are becoming extinct. They are raised in captivity and then released into remnant forest stands in agricultural areas. Management principles are based on applied research into the biology and ecology of the green iguana, carried out by the Iguana Management Project of the Smithsonian Tropical Research Institute in Panama.

An even higher survival rate could probably be achieved by raising the iguanas to adulthood in captivity, but this is not considered economically feasible. Although prolific in their reproduction, iguanas grow relatively slowly compared to traditional livestock animals such as chickens and rabbits. Iguanas are poikilothermic (cold blooded) animals. They need direct heat from the sun to digest the food they consume. Rate of growth is related to their ability to regulate heat absorption. Wild iguanas reach a weight of about 3 kg in three years. A rabbit will reach about the same weight in four months, consuming the same amount of food.

The green iguana is the only reptile that both feeds on trees and lives in trees. More than 60 tree species have been identified that serve as either food or habitat for the green iguana. The structure and diversity of the tree canopy is known to be critical for maintaining iguana populations. They seek out positions in the canopy that will be most favorable for exposure to the sun. In the wild they are most often found along river banks or near the edge of forest openings.

For iguana populations observed in the wild, the normal carrying capacity is about 45 adults per hectare. The repopulation program of the IMP has been able to significantly increase the carrying capacity of iguana habitat by making high protein food supplements available at feeding stations in the release areas. The iguanas visit the feeding stations regularly, which helps to reduce emigration from the release area. Based on current population densities, iguana management techniques are estimated to result in more than a 5-fold increase in adult carrying capacity compared to wild population densities.

The Iguana Management Project plans to begin testing harvesting techniques during the coming year. Rather than use traditional methods of capture, which are highly disruptive to the remaining animals, various forms of scent or food baited traps will be tried. This will also permit the project to select precisely which iguanas are to be harvested. Each iguana has an individual number branded on its side before release, thus by comparing the numbers with project records, it is possible to determine the exact age, kinship group, and other details for each animal. Selective harvesting will help keep the released population healthy and will add to the information that has already been accumulated by the project about iguana biology and behavior. ●

The increasing conflict over the need for increased food production and the environmental problems resulting from agricultural expansion or intensification has proven difficult to resolve in many regions of the world as well as in Central America. An approach known as agroforestry has received much attention in recent years because of its potential as an alternative to conflicting land use needs. The term agroforestry is usually applied to farming systems in which trees are an integral component, not only for the products they contribute (wood, fruit, fodder, etc.), but also for their contribution to the sustainability of the system through erosion control and nutrient cycling. Agroforestry systems can involve intercropping rows of trees with annual or perennial crops, or a rotation between various land uses, such as trees, crops, tree crops, and grazing. Livestock are often included as a major component of the system, but little research has been done on the role of wildlife in agroforestry.

Nevertheless, agroforestry offers an ideal solution to the problems faced by the IMP in designing a reforestation component. Soil conservation techniques such as the use of shelterbelts and contour strips are among the most useful methods by which agroforestry contributes to the sustainability of an agricultural system over time. Unlike monocultures, agroforestry emphasizes increasing biological diversity for ecological stability and the products that can be harvested for economic security. Agroforestry systems are designed around the needs of the farmer, to include tree, crop, and livestock species that will be useful and appropriate, and that can be adapted to holdings of any size.

System Helps Farmers and Iguanas Alike

The reintroduction of the green iguana also provides an ideal solution to the problem of reforestation on cleared-over farmlands. Iguana management provides an incentive to farmers to undertake agroforestry efforts that they ordinarily would not even consider. Harvesting the iguanas for meat or market will help offset any costs to the farmer involved in tree planting. Preliminary calculations based on results from the release program so far indicate that raising iguanas may prove to be even more profitable for farmers than cattle ranching. Several farmers who heard that the IMP was planning to start a reforestation project have already requested that they be included in the pilot efforts, and have offered their land for use as research sites.

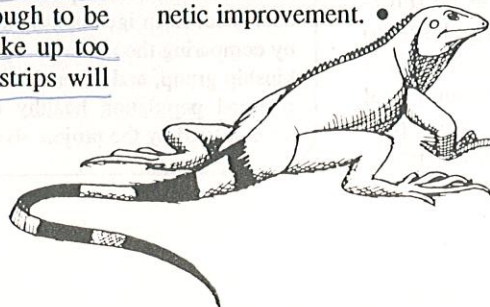
The agroforestry research design draws on the traditional use of living fence rows planted around farm fields. The trial plots will be vegetation strips approximately 100m long and 15-20m wide, wide enough to be home to the iguanas, but not so wide as to take up too much of the farmers' fields. These vegetation strips will

be planted as shelterbelts around the fields and pastures on ranches and farms in the lowlands, and as contour strips on steeper slopes, to protect against erosion from surface runoff on denuded hillsides. The vegetation strips will be wider than most fence rows, and will be made from more different species, including fruit trees, fencepost trees, and trees for timber and fuelwood.

This experimental design was chosen not only because the vegetation strips will fit naturally into typical landscapes and land uses, but also because it is more suited to the needs of the iguana than a solid block of forest would be. Iguanas are cold blooded animals, and they need exposure to both morning and afternoon sun to absorb the heat necessary to maintain their metabolic processes. They are more likely to be found on the edges of forest openings than in the center of a stand where the shade is deepest. This edge effect can be maximized by planting trees in strips, rather than in blocks. The strips will contain several rows of trees, stratified according to height. The tallest, fastest growing species in the center will be occupied by the largest iguanas. Fencepost trees will be planted in the outside rows, and will be kept pruned back, to provide low perches for the smaller iguanas. Thus iguanas of all sizes and ages will have their place in the sun. Barbed wire will be strung to the fencepost trees to keep grazing cattle out of the trial plots, and the pruned branches can also be used by the farmers.

Small nurseries have already been started in Cabuya and Chupampa, and members of both communities are starting to learn how agroforestry can benefit both them and the iguanas. This project could lead to broader conservation benefits for Panama and other countries in the region. By increasing the sustainability of agricultural systems through agroforestry and iguana management, farmers will no longer be forced to abandon their farms after years of intensive use. They will be able to stay on land that has already been cleared, and make it more productive, rather than invading the remaining forest areas to create new farms, which will in turn be abandoned. By offering the farmers an alternative to the environmentally damaging agricultural practices now common, it is possible that the Iguana Management Project could provide a solution to the accelerating rate of deforestation occurring throughout Panama and Central America.

Additional funding is now being sought by the project, however, not only to carry out the agroforestry research described here, but also to provide ongoing support to fundamental studies on iguana biology and management. If new sources of funding cannot be found, the IMP may not be able to continue to maintain the 4,000 iguanas that are now being used for breeding purposes, as well as for research on nutrition, preventive medicine, and genetic improvement. •



VITA

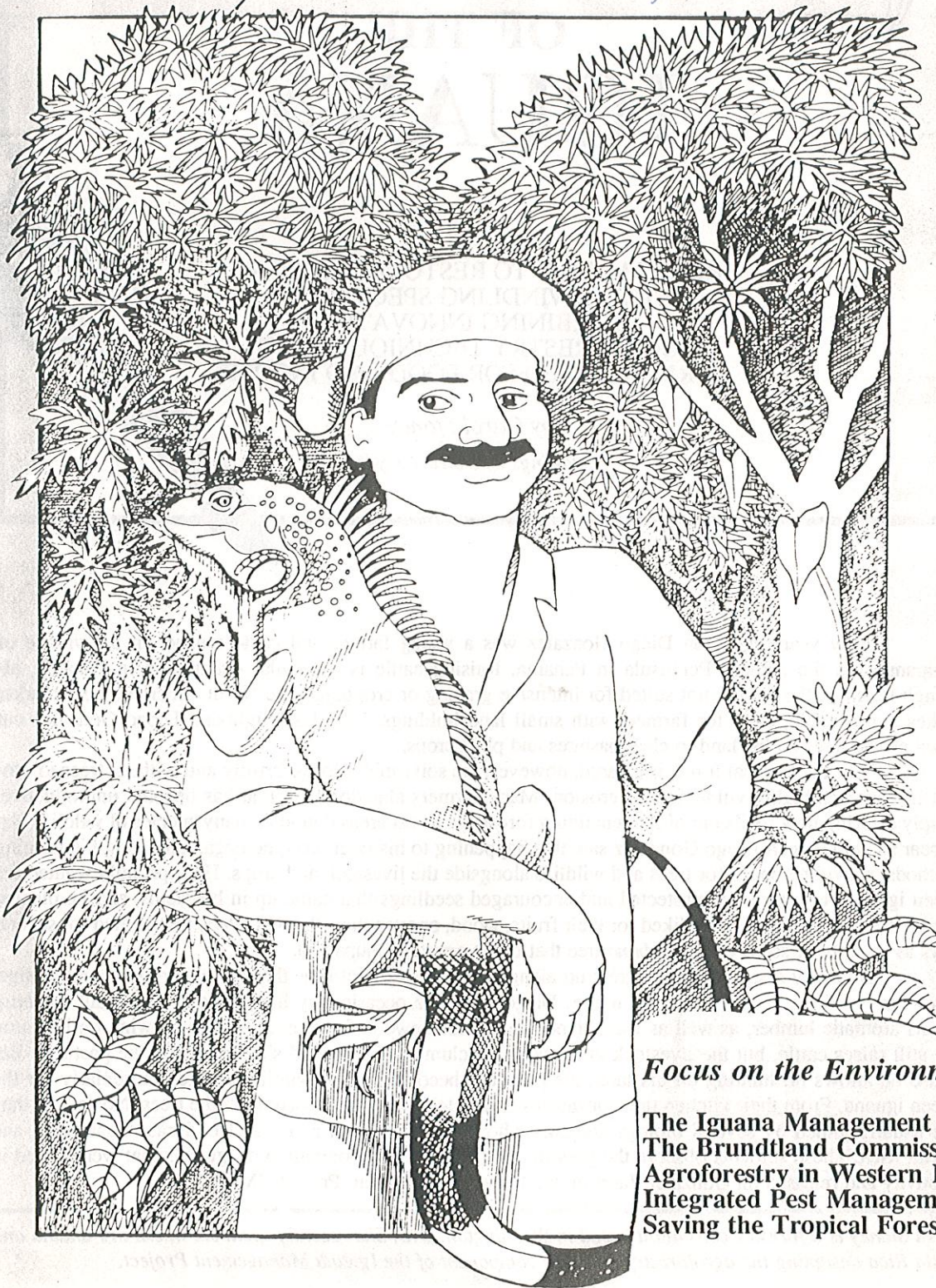
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October 1987



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