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and lives very much like the English or House Sparrow which is such a nuisance in urban and farm areas around the world. The tree sparrow is aggressive and will drive out some of the more beautiful and interesting native song birds in the areas it occupies. It is also a bird disease carrier.

The Micronesian Megapode is indicated on the list above as a resident bird. It has been presumed by ornithologists that this bird (or rather the Marianas subspecies - there is another subspecies in Palau) has been extinct on all the Mariana Islands from Guam to Saipan for fifty to one hundred years. It is still known to exist in very small numbers on some of the Mariana Islands north of Saipan. The Micronesian Megapode is a chicken sized bird with big feet that scratches together a huge mound of soil and compost (sometimes six feet high and fifteen feet across) and deposits its eggs in the mound. The eggs are incubated not by the parents but by the heat of the decaying compost within the mound. The writer was greatly elated when told by a reliable informant that two of these birds had been seen only two weeks before his arrival on Tinian. This was a surprise but not too great a surprise because the writer had seen megapodes on Agiguan Island just south of Tinian in 1955. Several local informants, on questioning, accurately described the bird including its big feet, crest on head and mound building activities. In addition they knew the correct Chamorro name for the bird - "Sasengay". This information came too late for the writer to mount any adequate search for the bird or its telltale incubation mounds but he is convinced that a sufficient search will reveal that the Marianas Megapode is still resident on Tinian after this long period of presumed extinction.

THE ASSUMED IMPACT ON THE FAUNA AND FLORA OF TINIAN BY THE PROPOSED MILITARY BASE

Now that the physical setting, the ecological history and the present status of the fauna and flora of Tinian has been described, the crux of the matter is to attempt to judge the impact on the fauna and flora of the building and operation of the proposed military base and the ecological changes that it will effect. Although the writer has some information on the proposed structures, highways, airfields, etc. that are planned, he does not know precisely where they will be located on the approximately two thirds of the island of Tinian that the military proposes to lease and use. Nor does he have more than a vague idea of the number of personnel, both military and civilian, that will be involved both during the construction

phase of the project and after the base is down to a routine operation. These facts are ultimately essential in making a reasonable impact statement. An attempt will be made, however, in any case.

Impact on the Flora

If the military could confine their construction work and ultimate operations to the previously highly disturbed lands used by the U.S. military at the end of world war II primarily, and then secondarily to the previous sugar cane lands now grown up in tangentangen, little or no adverse effect on the flora of Tinian will result. This would imply that construction and other soil and flora destructive activities be kept away from the original forests still extant on the ridges and cliffs, kept away from Lake Hagoi and if possible from the good agricultural soils presently in use, even though that use would cease during the time a military base is operating on Tinian. If it is found on subsequent investigation that there exist any individual specimens or general area of very rare plants or trees, then any such area should be exempted from any disturbance.

Impact on the Fauna

The existing fauna on the island of Tinian will be least disturbed and endangered if the remaining relatively undisturbed habitats on the island can be bypassed in the process of the construction and operation of the military base. Again, as in the case with the flora, the preservation of habitats as such, rather than the individual species of fauna, is the best basic policy. The loss to the fauna of some of the already highly disturbed land and vegetation would be a minimal loss, and since most of the species living in this type of vegetation have already proven themselves highly adaptable, there may be no overrall loss at all as far as the fauna is concerned if adequate landscaping is done after the construction phases of the project are finished. In the case of some individual species, however, there must be some special precautions taken. Lake Hagoi must be left intact and not filled, poisoned or oiled if any considerationis to be given to saving the Marianas Mallard and the Gallinule. Lake Hagoi is not only the sole refuge for the Marianas Mallard but also the only part of Tinian that can serve as a way station to migratory waterfowl. If the surmise that the Micronesian Megapode still survives on Tinian is true, then its minimum habitat must be delimited and set aside as undisturbed as possible.

The invertebrate fauna such as worms, spiders, mites, ticks and insects would be little affected in any way adverse to the ecology of the island. There could be some increase of pests insects on the ornamental and other plants used in the landscaping of the military area, but this need not be so if care is exercised to chose landscaping plants that are little or not at all affected by the pest insects which are presently on the island. The coconut crab will probably benefit by the operation of the military base since civilian hunting and commercial export of this animal will cease. Whatever collecting or hunting of this animal is done by military personnel for their own use probably would not affect their population adversely. This same situation will probably also obtain with regards to the fruit bat and it can be expected that the fruit bat populations will recover and flourish on the military base.

SOME GENERAL CONSIDERATIONS

In general, large military reservations, by their exclusive nature, become wildlife preserves and preserve fauna and flora which might otherwise be destroyed or badly harrassed by normal civilian development and use. This is self evident on Guam where the military reservations are the last stronghold of the indigenous fauna and flora of Guam. The writer is also well aware of this from experience in his home state of Washington and elsewhere in the United States. This premise assumes that the military administrators of these bases control the use and exploitation of the faunal and floral resources by military personnel - which is usually the case. Gross exceptions do occur and the following quote from "Birds of the World" by Oliver L. Austin, Jr. is a case in point: "Sentiment has also always been on the side of the cranes in Korea and Japan, where the birds have been rigorously protected for half a century and small stocks maintained on their wintering grounds. Unrestricted poaching by occupation personnel after World War II drove the cranes from several of these sanctuaries or reduced their numbers." On the island of Tinian, wildlife which prospers on the proposed military base will serve as a reservoir for replenishing these resources on the southern third of the island occupied by the civilian population.

It is not within the instructions to this writer to comment on the sociological and economic impact of the military base on Tinian. However, where sociological and economic impact also affects the fauna and flora it seems germaine to discuss it here. The restriction of the civilian population of Tinian to the southern one third of the island portents that those land and resource use activities

that they have been carrying on all over the island will now be concentrated in that southern one third of the island. Furthermore, the anticipated influx of, first construction workers, and later civilian employees for the military base, will further intensify the land and resource use of the non-military land. A lot of this will be misuse and the fauna and flora of this area will probably suffer more than is presently the case. Of course, the Trust Territory government, the District Administration and the Tinian Municipality administration are all at liberty to devise laws and regulations to minimize land and resource misuse or over exploitation. Some such laws do exist at the present time. More are needed but neither existing or future resource laws will have much effect unless resources education and resource law enforcement procede together. Whether or not intensive agriculture will be carried on in the southern one third of the island after establishment of the military base, is open to question. There is still plenty of good agricultural land in the southern part of the island and markets for produce will continue in Guam and increase on Tinian with the military base there. However, when faced with the choice between a steady livable salary as a worker for the military, and the somewhat less certain but more profitable choice as a farmer, this writer feels that the agricultural pursuits will decline. On the surface of it, the fauna and flora of this area would profit by less exploitation of the land. However, the spectre of an Ebeye-like situation developing on Tinian, in general bodes no good for either the fauna and flora or the human population.

The military organization and personnel on Tinian will be subject, as all other Trust Territory residents are, to existing Trust Territory laws relating to conservation (including regulations of the Trust Territory Environmental Protection Board), land use and plant and animal quarantine. Some provisions must be made to allow Trust Territory employees to check on the observance of these laws and regulations. Plant and animal quarantine is a particular point in case. Presumably, military, and possibly some civilian aircraft will be both scheduled and irregularly arriving from other parts of the Pacific and the world at the military airport on Tinian. It will be necessary that Trust Territory Agricultural Quarantine Inspectors clear these incoming aircraft with respect to our plant and animal quarantine laws. This is necessary not only to protect the island from new insect and animal disease and weed introductions, but also to prevent the importation of exotic plants and animals which on establishment on Tinian could become detrimental to the island. Military personnel flying in from exotic places are wont to quite innocently bring in parrots, monkeys, potted plants, and other oddities that are potentially harmful in a new area. The Trust Territory quarantine permit system is a means for preventing this, or for passing judgement ahead of time as to what can or cannot be imported into the Trust Territory. Military and civilian ships coming into Tinian must be subject to the same surveillance.

With the housing of several thousand military personnel on Tinian there are going to be some problems concerning household pests, nuisance pests and mosquitoes, whether they are of health significance or not. Good sanitary practice as far as house cleaning, sewage disposal, pet control solid waste disposal and litter control should take care of these potential problems without any threat to the fauna or flora. Where normal sanitary measures do not control any particular pest, then the use of chemical control or other measures may be necessary. Aerial spraying of insecticides should not be considered. Too many other forms of life besides the target species are affected including beneficial species of insects such as honey bees and insects parasitic or predaceous on pest insect species - including the very species that the control measures were devised for. Restricted ground applied mist spraying around homes and working areas is usually more effective and less expensive than aerial spraying or fogging. Litter control is particularly important in mosquito control to prevent mosquitoes from breeding in rainwater collected in such litter. This also brings up the question of possible excessive mosquito breeding in Lake Hagoi which has been earlier suggested as one of the most important fauna and flora habitats on Tinian which should not be disturbed. In the first place, housing and working area could be located far enough away from Lake Hagoi that any mosquitoes breeding there would not be bothersome. Even if mosquitoes are breeding in quanity in Lake Hagoi, this doesn't necessarily mean that they are disease carriers or that they will attack human beings sufficiently to need control. Light traps can pick up thousands of mosquitoes and bodies of water be teeming with their larvae, but if they do not bite human beings regularly this is of no consequence. Also, mosquito fish or other mosquito biological controls could be introduced into Lake Hagoi if necessary. In any case, every means possible should be taken to prevent the filling in, chemical poisoning or oiling of Lake Hagoi.

It is this writer's understanding that solid waste disposal on Tinian is to be handled in the military area by sanitary land fill rather than by ocean dumping. With the porous limestone subsurface of Tinian, care must be taken that solutions from this landfill or from waste oil or chemical disposal do not filter unchanged into the water lense which is the fresh water supply for Tinian. An examination of existing U.S. Geological Survey maps of Tinian could avoid this error. Soil depths on Tinian are not great and the scraping up of enough soil to keep a normal sanitary land fill going would probably be detrimental to the area involved. There are numerous old limestone quarries on Tinian. Perhaps one of these could be used for solid waste disposal even without a soil covering if far enough removed from human activities on Tinian. Sewage disposal on Tinian will presumably be through a secondary treatment plant with the effluent being disposed of into the sea. From the terrestrial point of view this is fine. It should be mentioned

here that the beaches on the eastern side of Tinian are a horrible mess as the result of untold quantities of cans, bottles, plastic containers, etc. being piled up on these beaches. This material is coming from the shoreside solid waste disposal areas on Saipan. Perhaps the Air Force, once established on Tinian, would be willing to bomb Saipan to force correction of this situation.

The establishment of recreational facilities on Tinian for the military personnel could be accomplished without any particular detriment to the fauna and flora providing that recreation does not include shooting up the island. Golf courses, tennis courts, swimming pools and development of the available sandy beach areas are cases in point.

This writer has no information on the effects of noise pollution from aircraft operation as it might affect the existing fauna of Tinian. The effects, if any, will be presumed to be minor. There are no large nesting colonies of sea birds on Tinian so no physical interference with aircraft operation from this source need be anticipated.

No particular mention has been made concerning the Micronesian Development Corporation's cattle ranch on Tinian. Most of this ranch is within the area to be taken over by the military. The corporation has other land holdings in southern Tinian which they will presumably develop and continue their operation, though on a smaller scale. The writer visited several of the MDC areas on Tinian and had a talk with the manager of the operation. It appears that a relatively efficient beneficial agricultural operation is being carried on with minimal disruption to the ecology of the island.

The idea that rare and endangered species of plants and animals should be saved is more than a general attitude towards aesthetcis or something conceived by bird-watchers and people who like to go to sleep under trees. The idea that any living species is a part of a genetic gene bank on this earth that can never be replaced if the species becomes extinct, is a scientific principle which is difficult to explain to laymen. These gene banks are constantly being tapped for all sorts of beneficial scientific work in plant and animal breeding, development of disease resistant forms, and, in the case of plants, a part of the reservoir that can be explored for new medicines and other useful products.

Hopefully, the U.S. military, in taking over the use of a part of Tinian, will view its occupancy as a trusteeship of a part of Micronesia, which will someday be returned to the people in as good a shape, or better, than when they receive it. A concern for the fauna and flora of Tinian on the part of the military occupying Tinian will hope to ensure this premise.

The idea that military bases are subject to attack in time of war cannot be avoided, and such an attack or attacks on a military base on Tinian, particularly with nuclear weapons, would be nothing but bad for the fauna and flora of Tinian. The other side of this speculative coin is that if a U.S. military base on Tinian is conceived as military protection for Tinian, as well as the rest of Micronesia and the United States, then the protection of Tinian from foreign invasion and occupancy, and the possible excessive exploitation of the land and resources of Tinian by such an occupying power, as has happened in the past, then the lack of such military protection could be equally destructive to the ecology and existing fauna and flora of Tinian.

CONCLUSIONS

This writer, from his present knowledge of the fauna and flora of the island of Tinian, and the expected development and use of the island by the U.S. military, concludes that, although the ecology of the island will be somewhat changed, no overall deterioration of the fauna and flora of the island can be expected.

This environmental impact statement on the fauna and flora of Tinian and the possible effects of a military occupancy and use of the northern two thirds of the island can be considered preliminary only, and a further impact statement on the fauna and flora should be made at a later date when specifics of the constructions activities, construction locations, completed base operations, military population and imported civilian labor population are known.

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