# Executive Summary

Source: A Rapid Biodiversity Assessment of the Ajenjua Bepo and Mamang River Forest Reserves, Ghana: 17

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# Executive Summary

## INTRODUCTION

Across West Africa, forest cover has been reduced to less than 30% of its potential extent (Bakarr 2001). The highly fragmented forest patches that remain continue to be degraded or completely lost at an alarming rate. Based on high levels of species endemism, coupled with intense and ongoing threats to their survival, the remaining West African forests have been designated as one of 34 global hotspots of biodiversity (Mittermeier et al. 2004).

Shifting agriculture had likely occurred in Ghana for centuries, but the rate of deforestation accelerated in the early 1900s (Thompson 1910) because of timber needed for newly mechanized gold mines, development of communications, and a rapidly expanding area of farmland, including cocoa (Hawthorne and Abu Juam 1995). In the 1920s and 1930s, foresters in Ghana demarcated and placed under management 280 forests for the purpose of ensuring the sustainable use of Ghana's forest resources and the preservation of forests with important roles as watersheds and windbreaks. Since this time, Ghana has lost roughly 80% of its forest habitat (Cleaver 1992) and about one-third of Ghana's forest is estimated to have disappeared in the 17 years between 1955 and 1972 (Hall 1987). Of the original forest zone covering 82,260 $km^2$, the area under forest in 1973 amounted to 20,530 $km^2$ including 16,790 $km^2$ within forest reserves distributed throughout the forest zone (Anon 1973). In 1988, forest cover in Ghana was estimated to be around 15,842 $km^2$ with the annual deforestation rate estimated at 220 $km^2$ (Sayer et al. 1992). Virtually all areas which still contain good quality forest today are located within the reserves designated under the supervision of the Forest Services Division of the Forestry Commission. Many of these forests have retained a significant integrity, in the sense that the boundary lines laid down seventy years ago are still respected and the boundary lines are regularly cleared and quite prominent.

The Ajenjua Bepo Forest Reserve (hereafter referred to as Ajenjua Bepo) and the Mamang River Forest Reserve (hereafter referred to as Mamang River) are located in the Birim North District of the Eastern Region of Ghana. The two reserves consist of moist semi-deciduous forest and were established in 1930 (Ajenjua Bepo) and 1938 (Mamang River). Ajenjua Bepo is a relatively small reserve covering an area of hilly topography of 5.69 $km^2$. Mamang River is relatively much larger and flatter, covering an area of 53 $km^2$.

### Scope of Project

CI and Newmont Mining Corporation are engaged in a partnership at both a corporate level as well as in the field in areas of mutual interest to promote biodiversity conservation. As part of that collaboration, Conservation International Ghana (CIG) formed a partnership with Newmont Ghana Gold Limited (NGGL) to ensure that potential biodiversity issues and conservation opportunities at and around NGGL's operations in Ghana are evaluated and managed such that CIG and NGGL together make measurable contributions to the conservation of Ghana's natural heritage. One objective of this partnership was to better understand the biodiversity context around the Akyem project site[1] in order to incorporate biodiversity into the company's risk assessment and help inform the project's Environmental Impact Assessment.

1 Akyem is Newmont's second project in Ghana, located approximately 80 miles (125 km) northwest of Accra. It is currently a development project awaiting approval for permitting from the government of Ghana before proceeding as an operational mine.

This partnership involved conducting a Rapid Assessment Program (RAP) survey in the two forest reserves adjacent to the Akyem project – the Ajenjua Bepo and Mamang River forest reserves, to increase understanding of the broader area's ecosystems.

The RAP survey was conducted from August 24 to September 4 2006 to assess a wide range of taxa, as well as potential threats to and opportunities for conservation in Ajenjua Bepo and Mamang River.

**RAP Expedition Overview and Objectives**

Conservation International's Rapid Assessment Program (RAP), a department within the Center for Applied Biodiversity Science (CABS), was founded in 1990 in response to the increasing loss of biodiversity in tropical ecosystems. RAP is an innovative biological inventory program designed to generate scientific information to catalyze conservation action in tropical areas that are under imminent threat of habitat conversion.

Together with CI's Ghana program and Center for Environmental Leadership in Business (CELB), RAP organized a rapid biological survey of Ajenjua Bepo and Mamang River from 24 August to 4 September 2006. The primary objective of the RAP survey was to collect scientific data on the diversity and status of species in order to make recommendations regarding their conservation and management. The specific aims of the expedition were to:

- Conduct a rapid, first cut assessment of species diversity within Ajenjua Bepo and Mamang and evaluate their relative conservation importance;
- Undertake an evaluation of threats to this biodiversity;
- Compare the biodiversity profiles of the two forest reserves;
- Provide management and research recommendations for these areas together with conservation priorities; and
- Make RAP data publicly available for decision-makers as well as members of the general public in Ghana and elsewhere, with a view to increasing awareness of this ecosystem and promoting its conservation.

**RAP Criteria**

Criteria generally considered during RAP surveys in order to identify priority areas for conservation across taxonomic groups include species richness, species endemism, rare, new to science, and/or threatened species, and critical habitats. Measurements of species richness can be used to compare the number of species per area among areas within a given region. Measurements of species endemism indicate the number of species endemic to some defined area and give an indication of both the uniqueness of the area and the species that will be threatened by degradation or loss of that area's habitats (or conversely, the species that will likely be conserved through protected areas). RAP scientists use the IUCN Red List of Threatened Species (IUCN 2008) to determine if species are globally threatened. Categories, from most to least threatened include: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC). Assessment of rare and/or threatened species that are known or suspected to occur within a given area provides an indicator of the importance of the area for the conservation of biodiversity. The presence or absence of such species also aids assessment of their conservation status. In addition to the Red List, in Ghana, for the purpose of prioritizing plant conservation each plant species has been assigned to a star category, based on rarity. Black star species are internationally rare and uncommon in Ghana and urgent attention to the conservation of these species is called for. RAP highlights Ghana's star ratings over the Red List because currently very few of the plant species in West Africa have been assessed by the IUCN and those that have been assessed were done opportunistically. This means that some groups of plants are represented (trees) and others are missing (lianas, epiphytes).

**RAP Team and Focal Taxonomic Groups**

The multi-disciplinary RAP team included representatives from the Ghana's University for Development Studies, the University of Ghana, the Water Research Institute, the Kwame Nkrumah University of Science and Technology, the Forestry Research Institute of Ghana, Station d'Ecologie de Lamto (Côte d'Ivoire), Uniwersytet im. Adama Mickiewicza (Poland), University of California - Berkeley (USA), and Harvard University (USA).

The RAP team, comprising experts specializing in West Africa's ecosystems and biodiversity, surveyed selected taxonomic groups to determine the area's biological diversity, its degree of endemism, and the uniqueness of the ecosystem. RAP expeditions survey focal taxonomic groups as well as indicator species, with the aim of choosing taxa whose presence can help identify a habitat type and its condition.

At Ajenjua Bepo and Mamang River, the RAP team surveyed plants, ants, orthoptera (katydids), butterflies, freshwater macroinvertebrates, fish, amphibians and reptiles, birds, and mammals.

**Study Area**

Site 1. **Ajenjua Bepo** (24 - 30 August 2006)
N 06° 22' 2.3", W 01° 01' 58.6" WGS 84
Elevation: 150-300 m a.s.l.

This is a small reserve that covers an area of 5.69 km$^2$ and has a hilly topography. It is adjacent to the northern border of Newmont's potential mining site. Ghana's Forest Services Division (FSD) ranked it as Condition 4 meaning that it is "mostly degraded." The reserve was last legally logged in 1989 and only small patches of the original moist semi-deciduous forest remain. The RAP campsite was located on

the edge of the largest patch next to a plantain plantation. The forest canopy is open and contains many large gaps, with larger trees reaching up to 40-50 m, emerging above a sub-canopy of 10-20 m height. There is little leaf litter on the forest floor. The remainder of the reserve is covered by degraded secondary forest or agricultural plantations such as cocoa, plantain, and oil palm. There were a few small streams that were all dry during the survey with the exception of one, near the edge of the reserve. Weather conditions influenced the survey results as there was no significant rainfall during the survey.

Site 2. **Mamang River** (31 August - 4 September 2006)
N 06° 15' 0.2", W 01° 02' 25.7" WGS 84
Elevation: 130 m a.s.l.

This reserve is much larger (53 km$^2$) and has a relatively flat topography. It is a moist semi-deciduous forest. The RAP campsite was located south of the center where the reserve narrows to only a few kilometers wide. The forest is uniform with dense tangles of lianas and a thick leaf litter layer. This reserve was ranked as Condition 2 meaning "good" by the FSD. Similar to Ajenjua Bepo, the forest canopy is open and presents numerous large gaps, with emergents reaching up to 40-50 m. In some places, the sub-canopy of 10-20 m height is closed. The streams in this reserve were also dry and agricultural plantations of cocoa, oil palm, plantain, and citrus bordered most of the reserve. Overall, the forest and streams were still dry but, unlike the time at Ajenjua Bepo, rain fell on several nights during the survey of this site.

## RAP RESULTS BY SITE

(see Tables 1 and 2 for summaries)

### Ajenjua Bepo Forest Reserve

There were 783 species, excluding freshwater macroinvertebrates, found in Ajenjua Bepo. This included 29 species of conservation concern, 25 of which were plant species, and ten new species to science. There was a greater number of plant, diurnal butterfly, katydid, amphibian and reptile, bird and small mammal species found here as compared to Mamang River. However, the higher numbers alone don't indicate a better candidate for conservation. Greater species diversity, especially in katydids, is most likely higher due to habitat fragmentation and the sun and wind's affects on the edge of the forest. Opportunistic species take advantage of these conditions and increase the number of species found. Only 35% of the amphibians and reptiles were recorded in forested areas illustrating the affects that the conditions are having on species diversity.

### Mamang River Forest Reserve

There were 652 species, excluding freshwater macroinvertebrates, found in Mamang River, including 27 species of conservation concern (22 plant species) and seven new species to science. A greater number of ants, freshwater macroinvertebrates, fishes and large mammals were found at this site. The larger core and uninterrupted forest of Mamang River increases the habitat needed for large mammals like antelope to move and feed. Small mammals like forest shrews and murid rodents also benefit from the more structured arboreal vegetation. The boundaries of this reserve are well-defined by agriculture and footpaths are present providing access to opportunistic species.

**Table 1.** Number of species documented during the RAP survey in the Ajenjua Bepo and Mamang River forest reserves, Eastern Ghana and comparison of sites.

| | Site 1: Ajenjua Bepo | Site 2: Mamang River | Total # species |
|---|---|---|---|
| **Dates** | 24-30 August 2006 | 31 August-4 September 2006 | |
| **Elevation** (m a.s.l.) | 150-300 | 130 | |
| **Area** (km$^2$) | 6 | 53 | |
| **Habitat** | Hilly topography, 'mostly degraded' with small patches of original moist semi-deciduous forest | Relatively flat topography, 'good' condition moist semi-deciduous forest. Uniform forest with dense tangles of lianas and a thick leaf layer. | |
| **Plants** | 325<br>3 black star species | 215<br>3 black star species<br>Larger area of continuous good forest | 376 |
| **Ants** | 98 | 101 | 125 |
| **Diurnal Butterflies** | 128 | 116 | 187 |
| **Katydids** | 50 | 33 | 56 |
| **Freshwater macroinvertebrates** | At least 26 families | At least 29 families | |
| **Fishes** | 7 | 16 | 18 |
| **Amphibians and Reptiles** | 31 | 30 | 45 |
| **Birds** | 121 | 115 | 137 |
| **Small mammals** | 16 | 11 | 18 |
| **Large mammals** | 10 | 16 | 16 |
| **Total species recorded** | 785 | 654 | 978 |

## RAP RESULTS BY TAXONOMIC GROUP

(see Tables 1 and 2 for summaries)

**Plants** A total of 376 plant species belonging to 76 families were recorded. There were 33 plant species of conservation concern but this is probably low because the IUCN Red List for plants in West Africa is incomplete and the species that were assessed were done opportunistically. Some groups of plants are represented (trees) while others are missing (lianas, epiphytes). At Ajenjua Bepo, 325 plant species in 73 families were recorded, including three Black Star species (botanical species of the highest priority in Ghana's color-coded conservation categories): *Monocyclantha vignei* (EN), *Berlinia occidentialis* (VU) and *Albertesia scanden*. At Mamang River, 215 species in 58 families were confirmed including three Black Star species: *Aubreginia taiensis* (CR), *Leptoderis miege* and *Tapura ivorensis* (VU). Of the two reserves, Mamang River had a larger area of continuous good forest.

**Ants** Using the ALL protocol (leaf litter sifting), 125 ant species belonging to 40 genera and 11 subfamilies were recorded, including 98 species from the Ajenjua Bepo site and 101 from Mamang River. The two sites seemed equivalent in terms of ant community species richness and composition. At both sites, the forest habitats were more species-rich as compared to the cocoa plantations, which were characterized by the presence of ant species typical of open areas.

**Butterflies** During 11 days of field work in Ajenjua Bepo and Mamang River, 1800 specimens of butterflies and moths (Lepidoptera), representing 486 species in 18 families, were collected. The survey focused primarily on diurnal butterflies of the superfamilies Papilionoidea and Hesperoidea, with 187 recorded species (128 at Ajenjua Bepo and 116 at Mamang River). Twelve species are of particular conservation interest and are discussed in detail in Chapter 3. A clearwing moth *Metasphecia xanthopyga* Aurivillius 1905 (Sesiidae) represents both the first record of this species for Ghana, and the first male specimen ever collected.

**Orthoptera (Katydids)** Fifty-six species of katydids were collected, of which 13 are new to science, and, in addition to these, 13 are new species records for Ghana. Ajenjua Bepo shows a higher species count (50 species) than Mamang River (33 species), most likely a result of higher fragmentation of the habitat and a stronger edge effect than within Mamang River.

**Freshwater macroinvertebrates** The two forest reserves surveyed are watersheds for tributaries of the Pra River. The most common families in the survey were the Chironomidae (flies), Baetidae (mayflies) and Dytiscidae (diving beetles). Some species recorded were those adapted to polluted waters. The occurrence of families of Gastropoda (snails) in streams associated with the two reserves is of medical importance as some species of these families are hosts of schistosomiasis in Southern Ghana. No species of Plecoptera (stoneflies) or Trichoptera (caddisflies), indicators of good water quality, were recorded.

**Fishes** The fish fauna, mainly of dry season pools at the time of study, were surveyed using mini-seine nets and a battery of four mini-gill nets with four different mesh sizes of net. Eighteen fin-fish species belonging to 11 genera and 7 families and the reed shrimp were encountered. Of the fish species, seven were recorded from Ajenjua Bepo and 16 were recorded from Mamang River. Eight of the fin-fish species are not considered typical forest fish species. Their occurrence was attributed to some locations sampled being at the fringes of the forest area and parts of the reserves being intensely deforested. The record of *Barbus pobeguini* at Mamang River was, according to the literature, the first record of this species in Ghana.

**Amphibians and Reptiles** A total of 45 species of amphibians and reptiles (21 frogs, 1 caecilian, 13 lizards, and 10 snakes) were recorded during 12 days of fieldwork. Of these, 31 species were recorded from Ajenjua Bepo and 30 from Mamang River. The portrait of species richness at these sites decreases to only 17 species when considering only those species found in forest habitats. We documented one Near Threatened species, the Tai Forest treefrog *Leptopelis occidentalis* (IUCN 2008), which we found at both sites.

**Birds** During 11 days of field work, 137 bird species were recorded, 121 at Ajenjua Bepo and 115 at Mamang River. One species of conservation concern was recorded, Green-tailed Bristlebill *Bleda eximius*, classified as Vulnerable (recorded only from Mamang River) and the Near Threatened Grey Parrot *Psittacus erithacus* was recorded only from Ajenjua Bepo (IUCN 2008). Two of the 11 species restricted to the Upper Guinea forests Endemic Bird Area and 91 of the 180 Guinea-Congo forests biome species known from Ghana were observed during the study.

**Small Mammals** A total of 128 specimens belonging to at least 18 species were recorded including five species of rodent, six species of shrew and seven bat species. Within Ajenjua Bepo, six shrew species were recorded including four forest species. Despite the high degree of disturbance of the secondary forest, three specimens of *Crocidura muricauda* were collected. Only three species of murid rodents were collected, with two forest species. Six pteropodid bat species and a single insectivorous bat species were recorded. Within Mamang River, five or six shrew species were collected. With a similar trapping effort as at Site 1, a higher number of specimens (39) and species (5) of rodents were recorded within the Mamang River FR. Only four specimens of a single forest-dwelling bat species (*Myonycteris torquata*) were recorded within the forest, most likely a result of weather conditions during surveys. Both species richness and species abundance of the forest shrew and murid rodent species point to a higher conservation potential of Mamang River than Ajenjua Bepo. Mamang River appears to present better

conservation value due to 1) its larger size, 2) the absence of plantations within Mamang, and 3) the more structured arboreal vegetation within Mamang probably providing more fruit and leaf litter.

**Large Mammals** A total of 16 mammal species were directly observed, all 16 being present in Mamang River and 10 in Ajenjua Bepo. Of these, three species are considered to be Near Threatened on the IUCN Red List (2008): Maxwell's Duiker *Cephalophus maxwelli*, Black Duiker *C. niger* and Pel's Anomalure *Anomalurus peli*. Interviews suggested the possible presence in Mamang River of an additional seven species, including three more species of conservation concern: Olive Colobus *Procolobus verus*, Black-and-white Colobus *Colobus polykomos* and Royal Antelope *Neotragus pygmaeus*, all considered Near Threatened. Forest canopies of both reserves are open and habitat has been degraded through farming and hunting activities. Many footpaths were noted in the both reserves.

#### Conservation Considerations

Between 1990 and 2005, the deforestation rate in Ghana was very high (2.0%) compared to most other countries in West Africa, resulting in the loss of 25.9% (1,931,000 ha) of Ghana's forest cover over 15 years (FAO 2006). Degradation and depletion of forests through legal and illegal activities related to logging, bushmeat hunting, encroaching agriculture, and mining has severely reduced and fragmented the country's forest cover. Only designated forest reserves still contain significant forest blocks that serve as source areas for a broad variety of animal and plant species, protect watersheds and maintain Ghana's climate, thereby providing essential goods and services for the human population of the country (Agyarko 2001).

Struhsaker and Oates (1995) have long warned of the critical situation of Ghana's forest fauna and the potentially tragic consequences for primate diversity of continued forest exploitation. Amongst the ten forest species of monkeys occurring in Ghana, three species, all endemic to southwestern Ghana and eastern Côte d'Ivoire, are highly threatened by extinction (Oates et al. 1997). Given the particular context and history of Ghana, each forest fragment presently populated by primates, regardless of size, should be actively protected from further destruction and fragmentation.

## OVERALL RAP RESULTS

Both the Ajenjua Bepo and Mamang River forest reserves have been impacted by disturbance from fire damage, logging, and in some places, complete removal of forest vegetation. Ajenjua Bepo has also been impacted by exploratory mining activities. While these sites do contain pockets of quality forest and several threatened species, the RAP team does not consider either site to be of highest priority for biodiversity conservation in Ghana. Other areas in Eastern Ghana such as the Atewa Range Forest Reserve (see McCullough et al. 2007) have higher global conservation importance, are in significant need of funds for conservation, and are therefore more effective candidates for biodiversity conservation in Ghana.

However, since Ghana now has less than 15% of the country's original forest habitat (Cleaver 1992), it is essential to protect all intact forest that remains, especially in places already designated as forest reserves. Both the Ajenjua Bepo and Mamang River forest reserves do contain quality forest patches and key species, including 39 species of global conservation concern (Table 2). Based on the results of the RAP survey, the RAP team considers the Mamang River Forest Reserve to be more deserving of conservation efforts and thus of higher conservation priority due to several factors:

1) Mamang River is nearly ten times larger than Ajenjua Bepo (53 $km^2$ vs. 5.69 $km^2$), providing a larger, continuous habitat for flora and fauna – its larger size also has a stronger buffering effect to any negative changes caused by human activities in surrounding areas,
2) Mamang River is a part of a larger series of forest reserves, making it a candidate for part of a wildlife corridor. It is adjacent to the Auro River and Pra-Anum Government Forest Reserves and its preservation would increase the continuously forested area of the region,
3) While the RAP team documented a similar or higher number of species in Ajenjua Bepo than in Mamang River, the composition of the species differs in a key way. Ajenjua Bepo is more fragmented and thus contains more open and edge habitats. This results in a higher number of heliophilous (sun-loving) species of butterflies, and more open-area, non-forest species of katydids, small mammals and other groups, which have invaded the forest in Ajenjua Bepo. The number of true forest species that need intact, undisturbed forest, is much lower than the total number recorded and was better represented at Mamang River.
4) Mamang River is less impacted by slash-and-burn agriculture, logging and mining exploration than Ajenjua Bepo,
5) Mamang River has a more structured arboreal vegetation that could provide more fruit, leaf litter and nesting sites for biodiversity,
6) Mamang River has higher number of large mammals, most likely due to its larger size (there is hunting pressure at both sites). There was no evidence of monkeys and fewer sightings antelopes in Ajenjua Bepo, and
7) Mamang River is not under direct threat since it is not currently (as of September 2008) under exploration for any mining activities.

Ajenjua Bepo Forest Reserve does have some key features that are also worth conserving, including:

1) A more topographically diverse terrain, with pockets of virtually pristine forest. Mamang River does not contain similar varied topography,
2) Several notable species recorded in Ajenjua Bepo and not in Mamang River, including the Grey Parrot (global conservation concern), several species new to science, and three Black Star plant species.

**Table 2.** Species of conservation concern recorded in the Ajenjua Bepo and Mamang River forest reserves during the 2006 RAP survey.

| Taxon | Species name | Common name | Threat status* | Sites | |
|---|---|---|---|---|---|
| | | | | Ajenjua Bepo | Mamang River |
| Plant | *Aubregrinia taiensis* | | CR / Black star | | x |
| Plant | *Cola boxiana* | | EN / Gold star | x | x |
| Plant | *Monocyclanthus vignei* | | EN / Black star | x | |
| Plant | *Tieghemella heckelii* | | EN / Scarlet star | | x |
| Bird | *Bleda eximius* | Green-tailed Bristlebill | VU | | x |
| Plant | *Albizia ferruginea* | | VU / Scarlet star | x | x |
| Plant | *Antrocaryon micraster* | | VU / Red star | x | x |
| Plant | *Berlinia occidentalis* | | VU / Black star | x | |
| Plant | *Cedrela odorata* ** | | VU | x | |
| Plant | *Cola reticulata* | | VU / Green star | x | x |
| Plant | *Cussonia bancoensis* | | VU / Gold star | x | |
| Plant | *Entandrophragma angolense* | | VU / Red star | x | x |
| Plant | *Entandrophragma candollei* | | VU / Scarlet star | x | x |
| Plant | *Entandrophragma cylindricum* | | VU / Scarlet star | x | x |
| Plant | *Entandrophragma utile* | | VU / Scarlet star | x | |
| Plant | *Guarea cedrata* | | VU / Pink star | x | x |
| Plant | *Guarea thompsonii* | | VU / Pink star | x | |
| Plant | *Isolona deightonii* | | VU / Gold star | x | |
| Plant | *Khaya anthotheca* | | VU / Scarlet star | x | |
| Plant | *Khaya ivorensis* | | VU / Scarlet star | x | x |
| Plant | *Milicia regia* | | VU / Scarlet star | | x |
| Plant | *Nauclea diderrichii* | | VU / Scarlet star | x | |
| Plant | *Nesogordonia papaverifera* | | VU / Pink star | x | x |
| Plant | *Placodiscus boya* | | VU / Gold star | x | |
| Plant | *Pterygota macrocarpa* | | VU / Red star | x | x |
| Plant | *Tapura ivorensis* | | VU / Black star | | x |
| Plant | *Terminalia ivorensis* | | VU / Scarlet star | x | x |
| Plant | *Turraeanthus africanus* | | VU / Pink star | | x |
| Plant | *Uvariodendron occidentale* | | VU / Gold star | | x |
| Bird | *Psittacus erithacus* | Grey Parrot | NT | x | |
| Frog | *Leptopelis occidentalis* | Taï Forest Treefrog | NT | x | x |
| Mammal | *Anomalurus peli* | Pel's Anomalure | NT | x | x |
| Mammal | *Cephalophus maxwelli* | Maxwell's Duiker | LR/nt | x | x |
| Mammal | *Cephalophus niger* | Black Duiker | LR/nt | | x |
| Plant | *Irvingia gabonensis* | | LR/nt / Green star | | x |
| Plant | *Milicia excelsa* | | LR/nt / Scarlet star | x | x |
| Plant | *Mangifera indica* | | DD | x | x |
| Plant | *Albertisia cuneata* | | Black star | x | |
| Plant | *Leptodermis miege* | | Black star | | x |

*The IUCN Red List categorizes species based on the degree to which they are threatened. Categories mentioned above, from most to least threatened, include: Critically Endangered (**CR**), Endangered (**EN**), Vulnerable (**VU**), Near Treatened (**NT**), Lower Risk/near threatened (**LR/nt**), Data Defcient (**DD**) (IUCN 2008).

The IUCN Red List for plants in West Africa is incomplete as many species have not been evaluated. Many botanists instead refer to the Star species ranking to indicate the conservation priorities in Ghana. Categories from highest to lowest conservation priority, include: **Black**, **Gold**, **Blue**, **Scarlet**, **Red**, **Pink**, **Green** (Hawthorne and Abu-Juam 1995).

** *Cedrela odorata* is not native to Ghana and was introduced as a tree plantation species. It is rated VU by IUCN 2008 due to its declining global distribution and increasing threats.

## CONSERVATION RECOMMENDATIONS

In order to conserve the remaining quality forest and key species in Mamang River and Ajenjua Bepo forest reserves, we recommend the following:

**Educate local communities regarding hunting regulations and why they are needed**. Illegal hunting is a serious concern for the conservation of mammals, large birds and reptiles. This is exemplified by the depauperate state of the mammalian fauna recorded from the two sites: Grubb et al. (1998) shows that 40 species of mammals should occur in the area, while the RAP survey documented only 16 species. Additionally, large birds such as the Crested Guineafowl, *Guttera pucherani*, and the Great Blue Turaco, *Corythaeola cristata*, were noticeably absent from the forest. Monitor lizards and turtles, while expected in the forest but not recorded, could also be at risk.

**Conduct longer-term surveys for all taxonomic groups particularly in the wetter and rainy seasons**. None of the RAP scientists recorded the number of species they expected to encounter for the area and all believed that the extremely dry conditions during the survey were likely a factor. Thus, additional surveys furing the rainy/wet season are necessary. Special attention should be given to determine the distribution of species of global conservation concern such as *Bleda eximius*, Green-tailed Bristlebill (Vulnerable) and *Leptopelis occidentalis*, Taï Forest Treefrog (Near Threatened).

**Improve sanitation in bordering communities** to decrease the impact of pollution (primarily human and animal waste) on aquatic invertebrates, fish, amphibians and local human communities. The occurrence of families of Gastropoda (snails) in streams associated with the two reserves is of medical importance as some species of these families are hosts of schistosomiasis in Southern Ghana. Sanitation in nearby settlements should be improved and dense vegetation cover of headwaters must be maintained to insure that streams, to some extent, flow throughout the year.

**Control deforestation and habitat degradation**. Fire damage from slash-and-burn agriculture and ethanol distillation of *Raphia hookeri* for the production of "palm wine" was noted during our survey, and these activities should be monitored and contained where possible. Habitat degradation resulting from grazing cattle in the forest and near forest areas should be limited to allow forest ground cover to grow and reduce soil compaction. Additionally, when rehabilitating degraded forests, it is strongly recommended that indigenous rather than exotic species be used for restoration efforts.

**Reduce the network of roads, plantations and paths adjacent to and within the forest reserves** which provide easy access for non-forest species of ants, rodents and specifically the plant genus *Ruspolia* to penetrate the habitat. Introduced and invasive elements often out-compete native species and can cause significant damage to individual populations and entire ecosystems.

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