Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2022; 10(5): 23-26

Received: 12-04-2022
Accepted: 16-06-2022

Kouadio Atta Léonard
Université Jean Lorougnon Guédé, Laboratory of Tropical Biology and Ecology, UFR Environment, BP 150 Daloa, Côte d'Ivoire

Assemian N'guessan Emmanuel
Université Jean Lorougnon Guédé, Laboratory of Tropical Biology and Ecology, UFR Environment, BP 150 Daloa, Côte d'Ivoire

Goly N'guessan Simplice
Université Jean Lorougnon Guédé, Laboratory of Tropical Biology and Ecology, UFR Environment, BP 150 Daloa, Côte d'Ivoire

Tiédoué Manouhin Roland
Ivorian Office of Parks and Reserves, South West Zone Directorate, BP 1342 Soubré, Côte d'Ivoire

Corresponding Author:
Kouadio Atta Léonard
Université Jean Lorougnon Guédé, Laboratory of Tropical Biology and Ecology, UFR Environment, BP 150 Daloa, Côte d'Ivoire

Impact of the transformation of forests into agricultural systems on the diversity of squamates in the Taï area

Kouadio Atta Léonard, Assemian N'guessan Emmanuel, Goly N'guessan Simplice and Tiédoué Manouhin Roland

DOI: https://doi.org/10.22271/j.ento.2022.v10.i5a.9043

Abstract
The exploitation of tropical forests for agricultural purposes is a major threat to tropical biodiversity. In West Africa, data on the effects of agricultural systems on biodiversity are lacking. We studied how squamates can survive in agricultural systems in southwestern Côte d'Ivoire. We examined squamate species richness in forest environments (primary and secondary) in the NWP and in peripheral agrosystems (mosaic coffee and cocoa plantations, rubber plantations and rice fields). We hypothesised that species richness decreases with increasing disturbance (presence of agricultural systems) between habitat types. However, squamate composition differs greatly between the forest (conserved environment) and the agricultural system (anthropised environment). Furthermore, the highest species richness of squamates was observed in the forest. The low species richness observed in the surrounding agricultural systems is due to the high level of disturbance of these habitats.

Keywords: Reptiles, tropical bio-diversity, agriculture, Taï National Park

Introduction
The Taï National Park (TNP), the largest block of primary tropical forest in West Africa, appears to be better conserved [1] and hosts a large part of the sub-regional biodiversity [2]. However, the socio-political crisis (from 1999 to 2002), the rapid increase in demography, food and economic needs have led to strong and increasing anthropic pressures on this environment, resulting in degradation, fragmentation, reduction of forest area, loss of habitats for many animal species and a continuous increase in the relative area of land [3, 4]. Indeed, in 2012, of the 10 hectares of forest around the TNP, only 0.3 hectares remained. These forests are exploited for agricultural purposes, including 9 hectares for perennial crops and 0.7 hectares for food crops [5]. Thus, agricultural practices have considerably reduced the forest reserve around the park [1]. In Côte d'Ivoire, studies on the effects of agricultural systems on biodiversity are lacking. However, it has been shown that squamates are particularly good at indicating the degradation of tropical forests [6, 7]. This is due to their low dispersal capacity, rarely exceeding one kilometre, which makes them very sensitive to climate change and habitat modifications [8]. In addition, Squamates play an important role in agriculture, by promoting the balance of ecosystems through the consumption of insect pests [9]. To fill these gaps, we focused on squamates in forest environments of the TNP and in agricultural systems on its periphery.

Materials and methods
Study sites
The Taï National Park (TNP) is located in the south-west of Côte d'Ivoire in the Sassandra-Cavally inter-river. It covers an area of 5,360 km2. The Taï area is the whole, made up of the NTP and its peripheral zone (ZP). It extends between 05°08' and 06°24' North latitude and 06°47' and 07°25' West longitude [1]. The 536,000 hectares of the Taï massif form a block of forest that is still more than 96% preserved. However, the peripheral zone is dominated by agricultural activities (coffee, cocoa, rubber, oil palm and rice). In terms of biological diversity for the higher plant group, TNP is home to more than 1,500 species, or at least 33% of the species in the West African rainforests. Of the species already recorded in the Taï area, 321 ares rares or endemic [10].

Methodology

Qualitative sampling was carried out on a monthly basis from May 2018 to March 2020 at twenty-five (25) sampling points installed in the park and fifteen (15) sampling points at the periphery (Fig. 1). Two sampling techniques were used simultaneously. These were all-round sampling techniques during reconnaissance walks and systematic excavation on plots (50 m x 50 m). At a given site, sampling was carried out by the same team of three people. The squamate inventory was carried out between 6:00 and 19:00. In TNP, 18 plots were set up in primary forest and seven plots in secondary forest. On the outskirts of the TNP, five plots are located in coffee/cocoa plantations, five in rubber plantations and five in rice fields. Using a GPS and a compass, the sampling consisted of a slow, silent walk with frequent stops. These stops allowed for discreet observation of the individuals with a pair of binoculars inside the vegetation. The individuals were then photographed, captured and identified. In the field, samples and photos of the different specimens were examined in order to identify the individuals down to the lowest possible taxonomic level following the nomenclature proposed by [11, 12, 13].

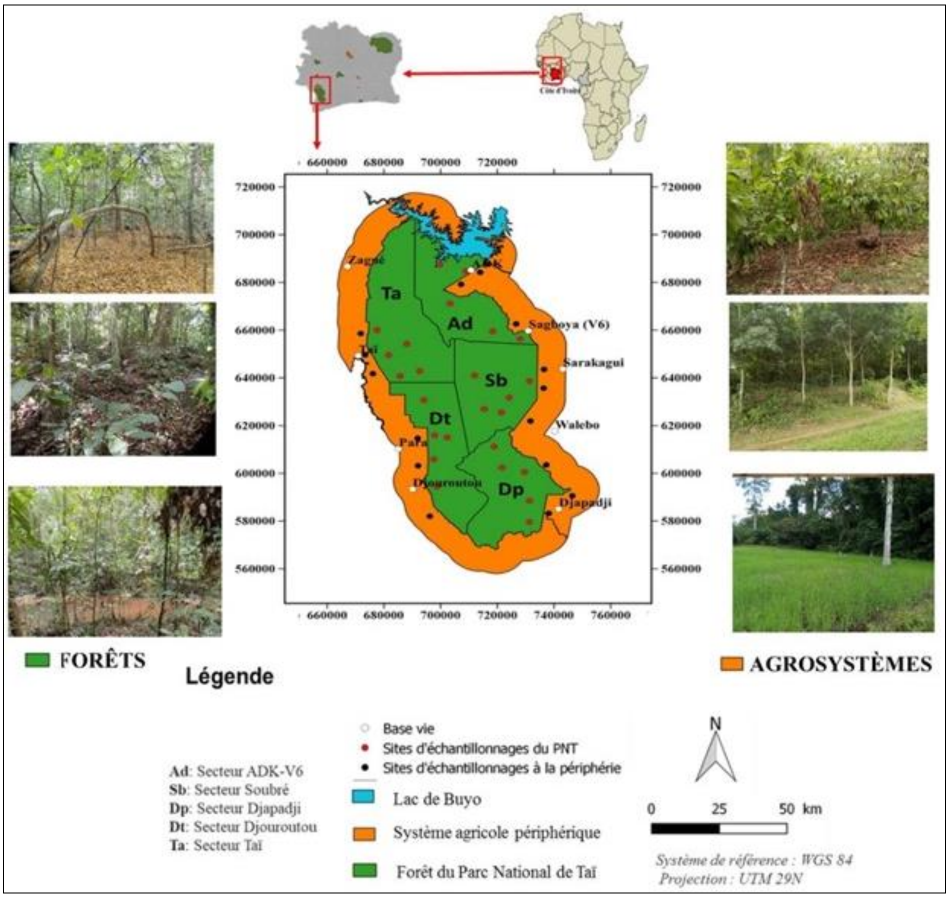

Fig 1: Location of the 40 sampling sites and partial view of the habitats of the Taï National Park and surrounding agrosystems

Data analysis

For the analysis of the data, we used the observed species richness, which is the number of squamate species observed in a stand. This parameter is used for comparative purposes [14]. Thus, the assessment of the impact of the conversion of forest to agricultural system was made on the basis of the number of species observed and the number of characteristic forest species observed in a control forest (PNT) and compared to that of the peripheral agricultural systems.

Results

The species composition of squamates in the ecosystems of the park and its periphery is presented in Table 1. Overall, 51 species of squamates were recorded in 38 genera, 15 families and 2 suborders. The distribution of squamates in the different habitats gives 46 species in the forests (PNT) against 27 species in the peripheral agrosystems. Of the 46 species observed in forests, 25 species are observed only in forests. Whereas in agrosystems, out of the 27 species recorded, only 5 species are observed only in these environments. Thus, forests and agrosystems are frequented by 22 common species. However, in forests, 33 forest species are recorded against 19 in agricultural systems. Among the 51 species of squamates, the suborder Ophidian is the most diverse, with 36 species, i.e. 70.59% of the overall species richness. The Saurians are the least represented with 15 species, i.e. 29.41% of the total number of species. The Saurians are made up of five (5) families. The Gekkonidae (6 species), Scincidae (4 species) and Agamidae (3 species) are the most diversified families. On the other hand, the Chamaeleonidae and Varanidae are represented by only one species each. The Ophidians are made up of ten (10) families. The family Colubridae (12 species) is the richest in species. It is followed by Lamprophidae (6 species), Viperidae (5 species), Elapidae (4 species), Atractaspidae (3 species) and Psammophiidae (2 species). The families Boidae, Leptotyphlopidae, Pythonidae and Typhlopidae are each represented by one species.

Table 1: Distribution of species according to the type of environment in the south-west of Côte d'Ivoire

Suborders	Families	Species	Forest of Taï National Park	Agricultural system
Sauriens	Agamidae	*Agama agama*	*	*
		Agama africana	*	-
		Agama sp.?	*	-
	Chamaeleonidae	*Chamaeleo gracilis*	*	-
	Gekkonidae	*Hemidactylus angulatus*	*	-
		Hemidactylus fasciatus	*	*
		Hemidactylus sp.?	*	-
		Hemidactylus mabouia	*	-
		Hemidactylus pseudomuriceus	*	-
		Lygodactylus conraui	*	-
	Scincidae	*Mochlus fernandi*	*	*
		Panaspis togoensis	*	-
		Trachylepis affinis	*	*
		Trachylepis paucisquamis	*	-
	Varanidae	*Varanus niloticus*	*	*
Ophidiens	Atractaspidae	*Aparallactus modestus*	*	*
		Atractaspis aterrima	*	*
		Polemon acanthias	*	*
	Boidae	*Calabaria reinhardtii*	*	-
	Colubridae	*Afronatrix anoscopus*	*	*
		Crotaphopeltis hotamboeia	*	*
		Dasypeltis fasciata	*	*
		Dipsadoboa unicolor	*	-
		Grayia smithii	*	-
		Hapsidophrys lineatus	*	*
		Hapsidophrys smaragdinus	*	*
		Natriciteres variegata	*	*
		Philothamnus irregularis	*	*
		Rhamnophis aethiopissa	*	*
		Telescopus sp.?	*	-
		Thelotornis kirtlandii	*	-
	Elapidae	*Dendroaspis viridis*	*	*
		Naja guineensis	*	*
		Pseudohaje goldii	-	*
		Pseudohaje nigra	-	*
	Lamprophidae	*Boaedon virgatus*	-	*
		Bothrophthalmus lineatus	*	-
		Gonionotophis klingi	*	-
		Hormonotus modestus	-	*
		Lycophidion irroratum	*	-
		Lycophidion nigromaculatum	*	-
	Leptotyphlopidae	*Myriopholis* sp.?	*	-
	Psammophiidae	*Psammophis phillipsii*	*	*
		Psammophis sp.?	-	*
	Pythonidae	*Python sebae*	*	*
	Typhlopidae	*Afrotyphlops punctatus*	*	-
	Viperidae	*Atheris chlorechis*	*	-
		Atheris hirsuta	*	-
		Bitis nasicornis	*	-
		Bitis rhinoceros	*	*
		Causus maculatus	*	*
Total: 2	15	51	46	27

Green band: Species observed only in forests; Orange band: species observed only in agrosystems; White band: species observed both in forests and in agricultural systems; Bold: forest species; Non-bold: degraded species; ?: status of the species unknown.

Discussion

The spatial distribution of the 51 squamate species recorded in the Taï area is as follows: 46 species in the forests against 27 species in the peripheral agrosystems. The high species richness of forest environments is due to the fact that these environments provide better shelter for these animals. This indicates good management and conservation of these habitats. Our remarks corroborate those of [15] who found that protected areas contribute enormously to the conservation and maintenance of a large number of animal species. Furthermore, the habitats provided by protected areas contribute to the feeding, breeding and migration (species entry) of these species [15]. Our results disagree with those of [16]. Indeed, according to these authors, due to the higher density of woody vegetation, forest environments should present more obstacles for squamate observation than agricultural systems. In addition, the higher shaded environment in forest environments would lead individuals to actively seek out areas with direct sunlight [16], which would make them more visible and counteract the effects of vegetation density on squamate detectability. Furthermore, our results show that the conversion of the woodlands around the park into agrosystems significantly influences the composition of the different squamate species. Indeed, in the park forest we observed 33 forest species (89.19% of the total number of forest species) against 19 species (10.81% of the total number of forest species) in the peripheral agrosystems. Our results are in contrast to those of [17], which state that in natural forests, thinning due to deforestation significantly increases the density of reptiles. Peripheral agrosystems with 27 species or 52.94% of the overall species richness contribute one-quarter (1/4) to the conservation of a large number of squamate species. Our findings are in agreement with those of [18, 19, 20] who state that although the ultimate purpose of forest plantations is food production, there is increasing evidence that they can play an important role in biodiversity conservation as they host a large number of native plants and animals, especially when managed in patterns known to favour wildlife. The presence of seven (7) species (*Agama agama*, *Causus maculatus*, *Boaedon virgatus*, *Crotaphopeltis hotamboeia*, *Natriciteres variegata*, *Python sebae*, *Rhamnophis aethiopissa* and *Trachylepis affinis*) indicative of disturbance or degradation of the forest environment both in the forest and in the agricultural systems, indicates that some of the habitats of the park would be anthropised as its periphery [6, 13, 17]. Indeed, according to [1], the park's forest environments closer to rural areas and highly accessible are anthropised.

Conclusion

The list of squamates collected includes a relatively high number of species (51 species), i.e. 98.07% of the number of species in the Taï National Park. Similarly, three categories of species are recorded: species observed only in forests (25 species), in agricultural systems (5) and mixed species (22 species). Of the 25 species restricted to the TNP, 19 are forest species and 6 are species of anthropised environments. Thus, the activities around the park have favoured the entry of species characteristic of highly degraded environments. Consequently, a programme for the protection and conservation of this fragile ecosystem, with the participation of the resident and riparian populations, should be strengthened. This will consist of stepping up surveillance of the park's areas very close to the periphery in order to avoid their extension. Although the encounter between humans and squamates leads to the large-scale killing of some squamates, the reasons for human dislike of squamates should be taken into consideration when developing squamate conservation strategies.

Acknowledgements

We are very grateful to the Ivorian authorities, in particular the Ministry of Health, Environment and Sustainable Development and the Office Ivoirien des Parcs et Réserves (OIPR), for allowing us to conduct this research. We thank the University Jean Lorougnon Guédé for its support during this study.

Références

1. OIPR. Plan d'aménagement et de gestion du Parc National de Tai 2014-2018. Abidjan, OIPR; c2015. p. 132.
2. Myers N, Mittermeier RA, Mittermeier CG, Da Fonseca GA, Kent J. Biodiversity hotspots for conservation priorities. Nature. 2000;403:853-858.
3. Bohoussou KH. Action pour la sauvegarde de la biodiversité de la réserve naturelle intégrale du Mont Nimba, Côte d'Ivoire: Evaluation de la diversité faunistique et campagne de sensibilisation. Laboratoire de Zoologie, Université Félix Houphouët Boigny de Cocody (Abidjan). Rapport final, MAB/UNESCO; c2014. p. 18.
4. Mallon DP, Hoffmann M, McGowan PJK. An IUCN situation analysis of terrestrial and freshwater fauna in West and Central Africa. Occasional Paper of the IUCN Species Survival Commission No. 54. Gland, Switzerland & Cambridge; c2015. p. 1-162.
5. Varlet F. Etude de la production du cacao en zone riveraine du Parc national de Taï, Rapport GIZ, OIPR, DZSO, Abidjan; c2013. p. 164.
6. Rödel MO, Mashberg D. Vorläufige liste der Schlangen des Taï –Nationalparks Elfenbeinküste und angrenzender Gebiete. *Salamandra*. 2000;35(3):25-38.
7. Akaffou MH, Chippaux JP, Allali KB, Coulibaly Z, Dosso M. Peuplement ophidien des plantations d'Hevea brasiliensis d'Anguédédou (Sud-Est, Côte d'Ivoire). Bulletin de la Société Herpétologique de France. 2017;162:31-38.
8. Marchand MA. Une méthode de suivi standardisée des communautés de reptiles squamates. Researchgate. DOI: 10.13140/RG.2.1.1809.4960; c2012. p. 43.
9. Willson JD, Winne CT. Evaluating the functional importance of secretive species: A case study of aquatic snake predators in isolated wetlands. Journal of zoology. 2016;298:266-273.
10. OIPR. Plan d'aménagement et de gestion du Parc National de Taï: 2009-2014. Abidjan, OIPR, 2006, 99pp.
11. Chippaux JP. Les serpents de l'Afrique occidentale et centrale. Paris (IRD) 3ème édition; c2006. p. 311.
12. Trape JF, Mané Y. Guide des serpents d'Afrique Occidentale, Savane et désert Paris, c2006. 32-51pp.
13. Trape JF, Trape S, Chirio L. Lézards, crocodiles et tortues d'afrique occidentale et du sahara. Marseille (IRD) 1 er édition; c2012. p. 505.
14. Ramade F. Eléments d'écologie fondamentale, DUNOD, Paris; c2003. p. 190.
15. Brönmark C, Hansson L. Environment issues in lakes and ponds: Current state and perspectives. Environ Cons. 2002;29(3):290-306.
16. Carothers JH, Marquet PA, Jaksic FM. Thermal ecology of a Liolaemus lizard assemblage along an Andean altitudinal gradient in Chile. Rev Chil Hist Nat. 1998;71:39-50.
17. Todd BD, Andrews KM. Response of a reptile guild to forest harvesting. Conserv Biol. 2008;22:753-761.
18. Hartley MJ. Rationale and methods for conserving biodiversity in plantation forests. Forest Ecology and Management. 2002;155:81-95.
19. Lindenmayer DB, Hobbs RJ. Fauna conservation in Australian plantations forests. A review. Biological Conservation. 2004;119:151-168.
20. Simonetti JA, Grez AA, Estades CF. Biodiversity conservation in agroforestry landscapes: challenges and opportunities. Editorial Universitaria, Santiago; c2012, p. 32.