



## **Agricultural Practices and Biodiversity Loss in the Nigeria Federation: A Study of Ini Local Government Area, Akwa Ibom State, Nigeria**

by

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### **Abstract**

*The study focused on agricultural practices and biodiversity loss in Ini Local Government Area, Akwa Ibom State, Nigeria with the view to determining the variations in biodiversity loss as a result of the diverse agricultural practices, assess the relationship between agricultural practices (land clearing, bush burning and soil tillage) and biodiversity loss and proffered sustainable strategies to reduce agricultural practices that leads to loss of biodiversity in Ini Local Government Area, Akwa Ibom State, Nigeria. In the analysis, 400 copies of the questionnaire were distributed using the random sampling technique to the six (6) clans in Ini Local Government Area and 386 were returned. The study revealed that land clearing was responsible for about 27.9%, bush burning 43.3%, soil tillage 23.1% and others 5.7% loss of biodiversity in Ini Local Government Area. The first tested hypothesis using the t-test showed that there was a significant variation in biodiversity loss as a result of agricultural practices. The second hypothesis, tested using Pearson's correlation showed that as agricultural practices increased, biodiversity loss also increased. Based on these, it was recommended that farmers should leave some land fallow while making use of other lands to ensure the sustainability of local biodiversity in the area. Also, farmers should be educated and encouraged to adopt eco-friendly agricultural practices that will reduce biodiversity loss in Ini Local Government Area, Akwa Ibom State, Nigeria.*

**Keywords:** Agricultural practice, Biodiversity loss, Species, Conservation, Habitat.

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### **1. Introduction**

World Rainforest Movement (2009) records show that 70-80 percent of Nigeria's original forest has disappeared and presently, the area occupied by forests is reduced to 12 percent. In the period between 2000 and 2005, Nigeria has lost about 2,048 hectares of forest (FAO, 2005). Although the Nigerian government established several forest reserves for conservation of forest resources, these forest reserves have been seriously neglected

and received little or no improvement in terms of investment and management. The implication of these losses is that many plants and animals, including many potentially valuable species are on the fast track to extinction. The USAID Report on Biodiversity and Tropical Forestry Assessment (2002) recorded that there are too many environmental threats in Nigeria affecting Biodiversity. A National Assessment, (2012) confirmed the reality of high rise and fast tracked increase in biodiversity loss in Nigeria. More than 70% of Nigerians live in rural areas where they depend on agriculture and other natural resources for their survival (Liu and Tian, 2010). Although Biodiversity supports the growing populations in rural and urban areas, the pressure is becoming increasingly higher due to overexploitation occasioned by high demand for food, shelter and clothing. In Nigeria, the rate of deforestation due to poor land use planning has been alarming. Bisong (2002) reported that Nigeria's forests are threatened as the forest cover declines from approximately 24 million hectares in 1975 to 15 million hectares in 1995 and down to 9.6 million hectares in 2011. World Rainforest Movement (2009) informed that the current extinction rate is now approaching 1,000 times the background rate and may climb to 10,000 times the background rate during the next century.

Pacicco (2018), in an effort to identify agro-biodiversity hotspots for priority in situ conservation of plant genetic resources, developed a methodology of taking as an example, a specific area of the Mediterranean hotspots for which sufficient data on agro-ecosystem ecological diversity, landraces and presence of wild species exist (i.e. Italy). In the study, the Italian area was subdivided into 995 quadrants by merging the International union for Conservation of nature 2x2 km grids into 20x20 grids with each quadrant being geo-referenced. The results indicated the various hotspots based on different levels of seriousness across the spans of land in Italy.

In another study, agro-ecosystem ecological diversity as a driver of biodiversity loss, to test this hypothesis, the Corine Land Cover (CLC 2006) which is based on satellite photographs was used which is qualified for use in such an assessment for the whole of Europe and the result showed that the analysis of land use changes is a key component to assess the loss of biodiversity worldwide.

In this study, the variations in biodiversity loss as a result of the diverse agricultural practices was tested using t- test analysis and the result showed that there was a significant variation in biodiversity loss as a result of agricultural practices. Also, in assessing the relationship between agricultural practices (land clearing, bush burning and soil tillage) and biodiversity loss the Pearson's correlation was used and the result showed that as agricultural practices increased biodiversity loss also increased.

Habitat loss and widespread use of agro-chemicals have posed significant negative consequences for wild flora and fauna (Matson et al, 2005). Active drainage for the creation of farmland (land reclamation) has caused a decrease in wetlands, which has led to direct damage and decline in many species of plant, mammal and insect, the removal of habitats such as trees, hedges, dry stone walls, woodland and scrub, together with land reclamation, create a decline in the native biodiversity, overgrazing has caused the destruction of many habitats especially peat lands and results in the exposure of bare rock and the widening of rivers, and increased braiding of channels, making their course

highly unstable from one flood to another, increased nutrient inputs through supplementary fertilizers, and nutrients has resulted in an increase in pollution of rivers leading to loss of biodiversity, bush clearing and bush burning can severely affect the natural habitat, the plants and animals that live in the area. When native plants and trees are removed, this result in the death of diverse species, displacement of species thus makes room for invasion of species to take over indigenous species habitat causing the endangerment and subsequent extinction of species. This decreases the biodiversity of an ecosystem that relies on it native flora and fauna to maintain a biological system of check and balance.

Nature is comprised of biological diversity. Soil is one of the most diverse habitats on earth and contains one of the most diverse assemblages of living organisms. A single gram of soil has been estimated to contain several thousand species of bacteria, of the 1500000 species of fungi estimated to exist worldwide (Hawksworth, 1991) remarkably little is known of soil fungi, apart from common fungal pathogens and mycorrhizae species. Among the soil fauna, some 100000 species of protozoa, 500,000 species of nematodes and 3000 species of earthworms are estimated to exist, not to mention the other invertebrate groups of the meso-fauna (e.g. Collembola; mites and enchytraeids) and macro fauna (e.g. ants, termites, beetles and spiders). Tillage alters many aspects of the soil's physical environment including: soil water, aeration, compaction, porosity, and temperature. Tillage renders soil susceptible to wind and water erosion which can affect the level of organic matter and nitrogen in the top layer of soils. Over half of the original wetlands of southern Canada have been lost, about 85% of them through agricultural land drainage (Keating, 1989). In southwestern Ontario the loss rises to 90%, while in the Prairies as much as 70% of the original wetlands are gone (Keating, 1989).

Mono-cropping destroys the soil. By planting the same plant in the same soil for years, the soil becomes more depleted over time. This in itself would be an issue – as it would lead to the production of lower quality plants. With monocultures being so popular, we end up using a number of fertilizers that actually pollutes the air and surrounding water sources. Monocultures eliminate biodiversity (which indirectly increases the need for pesticides). This creates two problems: one, there is no organic pest management – different species of insects cannot create natural population control of themselves or other insects – which leads to the second problem: because there is no natural aid in pest management, more pesticides are needed in order to control the pest populations.

In arable lands, intercropping, which break down the monoculture structure, can provide pest control benefits, reduced wind erosion, and improved water infiltration (Yamada et al., 2004). Some combinations appear to yield very good results, for example, the combined growing of corn and soybeans, which is a traditional cropping practice in some parts of the USA (Vink, 1983). In southern Australia and other Mediterranean environments, the practice of sowing clover together with wheat is common (Fraser, 1992). The clover is partly suppressed during the growth of wheat, then grows to maturity after the wheat is harvested, thus producing a certain amount of fodder and contributing to the nitrogen content of the soil. Intercropping can have a positive, negative or neutral

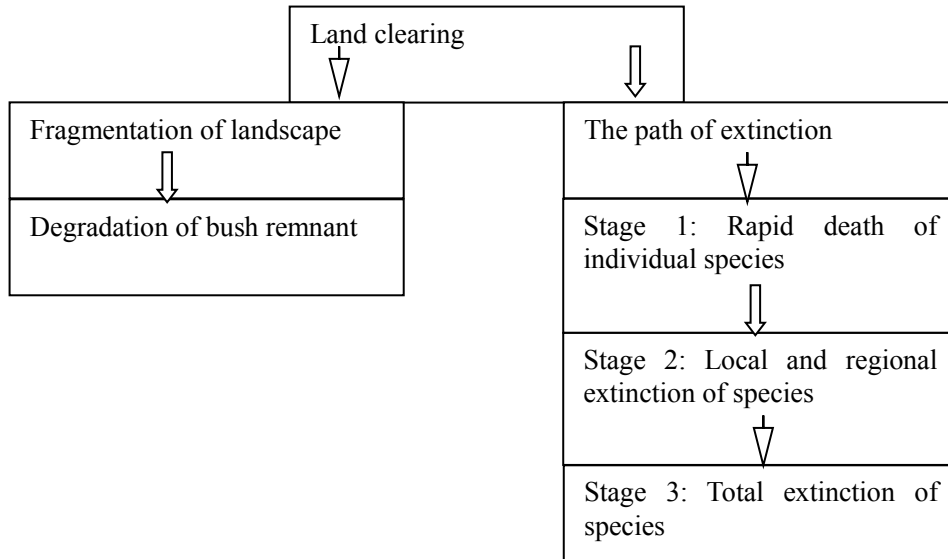
influence on the abundance of particular crop pests and probably must be evaluated on a case by case basis.

Livestock grazing affects over 60% of the world's agricultural lands and can influence rangeland ecosystem services and the quantity and quality of wildlife habitat, resulting in changes in biodiversity. In pastures According to Trotter (2008) ranging has been instrumental in protecting the Canadian prairies from destruction and rangelands are some of the most extensive and well managed tracts of native prairie. Cattle have a direct impact on plant communities by trampling and eating plants and compacting soil. It is possible to generalize in so far as to say that range vegetation cannot maintain its integrity if grazing pressure is too high. The effects of grazing by livestock for several bird and ungulate species while many species of wildlife can thrive in properly managed rangelands, grazing, under any system, has not been shown to enhance waterfowl production and is frequently detrimental to their populations. The 'rest-rotation' grazing system has been found useful for ameliorating some of the adverse impacts of season-long grazing on wild birds and mammals primarily because certain areas of pasture are left undisturbed at least part of the time. Compaction of soil by cattle has been found to make habitat unsuitable for some invertebrates, with detrimental effects for small animals such as shrews and frogs that feed on such invertebrates (Conner and Atkinson, 2004). An interesting footnote to modern livestock rearing techniques is that the use of therapeutic anti-parasitic drugs in cattle has also been shown to markedly affect the density of dipterans (fly) decomposing fauna, as well as other biota. Reduction of this insect fauna results in significantly retarded decomposition rates of animal dung. In addition to the regulation of grazing pressure, rangeland vegetation may be altered by re-seeding, pesticide use, removal of brush and suppression of wildfires.

Heavy treatment of soil with pesticides can cause populations of beneficial soil microorganisms to decline. Overuse of chemical fertilizers and pesticides have effects on the soil organisms that are similar to human overuse of antibiotics. For example, plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use. Common landscape herbicides disrupt this process.

Fertilizer application begins the destruction of soil biodiversity by diminishing the role of nitrogen-fixing bacteria and amplifying the role of everything that feeds on nitrogen. These feeders then speed up the decomposition of organic matter and humus. As organic matter decreases, the physical structure of soil changes. With less pore space and less of their sponge-like qualities, soils are less efficient at storing water and air. More irrigation is needed. Water leeches through soils, draining away nutrients that no longer have an effective substrate on which to cling. With less available oxygen the growth of soil microbiology slows, and the intricate ecosystem of biological exchanges breaks down.

In the process of land clearing, numerous individual plants and animals are killed or die soon after.



*Land clearing as a driver towards species extinction*

It has been estimated that between 1997 and 1999 when 446,000 hectares of remnant vegetation were cleared each year in Queensland that 2.1 million mammals, 8.5 million birds, 89 million reptiles and 190 million trees died as a result (Cogger et al 2007). Most plants and many animals die at the time of clearing, but many animals that manage to escape during the clearing process soon die from stress, starvation or predation. Mobile species that manage to reach remaining areas of vegetation are frequently repelled by the resident fauna resulting in diminishing breeding opportunities or having to compete with limited food and resources which leads to increase in level of stress and starvation and predation.

While widespread species are generally not threatened by single clearing events, the cumulative impacts of many smaller events resulting in habitat losses, fragmentation and degradation of remaining vegetation will result in a significant threat to the viability of even widespread species through the death by a thousand cuts scenario (Laurance, 2010).

What all this means is that modern agriculture has to change to become more biodiversity-friendly. One way is for farmers to leave some areas of land untouched. For example, neighboring farmers might be encouraged to protect adjacent areas of their farms, so that wildlife corridors that connect natural habitats are maintained or farmers might allow uncultivated areas to exist around, and within cultivated ones. This would allow grasses and other wild plants grow and it can go a long way towards conserving biodiversity. Another way to reduce the impact of agriculture on biodiversity is to develop farming techniques that minimize chemicals. Modern agriculture relies on a high level of chemical input. These include fossil fuels to drive machinery, as well as chemical fertilizers, pesticides and herbicides and all of which affect the ecosystem biodiversity. Furthermore, Policies governing the agricultural sectors, the use of natural resources,

protection and conservation of endangered species, habitats and biodiversity need to be aligned to better protect the environment and reduce the ecological footprint of agriculture, forestry and fisheries.

In Ini Local Government Area, massive hectares of land were cleared in Mbiabet for the establishment of the rice farm which has resulted in the loss of diverse species and also loss of habitat. Despite knowing about biodiversity importance for a long time, human activities like agricultural practices have been causing massive extinctions.

In the light of the above, the research, therefore, sought to investigate how agricultural practices in Ini Local Government Area posed serious threat to biodiversity and how such threat could be minimized.

## **2. Statement of the Problem**

Due to the desire of the people of Ini Local Government Area to be self-reliant in food production, there is an increasing agricultural practice which has led to the loss of habitat, endangerment, death and subsequent extinction of species. According to European Union 2011, cutting down forest or converting natural forest in to monoculture of pines and eucalyptus for industrial raw materials generates revenue and growth but this growth is based on robbing the forest of its biodiversity. An example is the destruction of a massive forested area in Ini Local Government Area for the cultivation of rice which has resulted in the loss of diverse biodiversity.

In past years, little research has been carried out in light of the above but this study sought to investigate beyond this extent and examine the variation in biodiversity loss as a result of diverse agricultural practices in Ini Local Government Area.

## **3. Aim and Objectives**

This research aimed at studying the various agricultural practices and biodiversity loss in Ini Local Government Area, Akwa Ibom State, Nigeria.

This aim was achieved through the following objectives:

- To examine the variations in biodiversity loss as a result of diverse agricultural practices.
- To determine the relationship between agricultural practices and biodiversity loss.
- To proffer sustainable strategies to reduce agricultural practices that leads to loss of biodiversity.

## **4. Materials and Methods**

The study adopted the survey inferential research design. This design was used because it enables relevant information relating to the study objectives to be obtained. The method involved personal observation, structured questionnaire, and oral interviews to obtain information about the varying agricultural practices and the extent of biodiversity loss as well as proffer sustainable strategies to reduce agricultural practices that leads to biodiversity loss in Ini Local Government Area of Akwa Ibom State.

- i. Population for Ini Local Government Area was obtained from National Population Census.

- ii. Data of the diverse agricultural practices in Ini Local Government Area from questionnaire.
- iii. Data of the extent of biodiversity loss due to these diverse agricultural practices obtained from previous researches by scholars

In adopting any method in research study, it is imperative to put into consideration the approach that will yield the most productive result relevant to the problem under study. In this regard, the data for the research was derived from the following:

***Data from Respondents in Ini Local Government Area by the Use of Structured Questionnaires:*** The used of questionnaire is a major way of getting information from people. In this study, 400 copies of the questionnaires were distributed across the six clans of Ini Local Government Area of which 386 questionnaires were collected and used for the analysis.

***Oral Interview:*** in this study, oral interview was conducted among indigenes of Ini Local Government Area and their response were collected and also used for the analysis.

***Personal Observation:*** Personal observation formed a vital part of the data collected and analyzed in the course of this study as it gave us a clear and unbiased data.

***Photographs of Information Obtained in the Field:*** Taking photographs in the field is very important as it helped retain information or not misinterpret information. Thus this study made use of photograph of information obtains in the field.

***Diversity Indices were derived from Direct Field Observation:*** For the data on the bio diversity indicators, the study focused on flora diversity in Ini local Government Area. Three sites where chosen in the study area and a 100m by 100m area was chosen for each site. Then the biodiversity index was computed using Simpson's Diversity index. The area was segmented into the disturbed site and the undisturbed site. The disturbed were the areas that these agricultural practices had been carried out on while the undisturbed site was the area that were barren and little or no significant activity has been done on them.

***Published and Unpublished Materials:*** This study derived his Data from published and unpublished materials about agricultural practices and biodiversity loss in Ini local government area such as periodicals, journals, magazines, dissertations, internet materials as well as the opinion of experts etc. that were related to the research problem. This helped in knowing the perspectives of other scholars on the research problem and also the extent of existing work that has been done by other scholars on the research problem.

The data for this study was collected by employing a systematic random sampling technique in sampling the six clans in the study Area. The reason for this sampling technique was employed was to give a 50/50 chance to respondents. Systematic random sampling was also used to determine the study sites for biodiversity measurement.

In order to determine the unit of data collected and analyze within the selected villages in the study area, different agricultural practices in six plots of land were studied within the six clans in Ini Local Government Area. The total population of the six clans in the study area base population was projected from 2006 to 2018 with an annual growth

rate of 2.3% (as obtained from National Population Census 2006) using the exponential growth model thus;

$$P_n = P_o (1+nr)$$

Where;  $P_o$  = base population

$r$  = growth rate of the population (2.3% as obtained from NPC)

$n$  = time lapse rate in a year

The projected population was used as a basis of determining the sample size. The total number of the respondents interviewed was determined by expressing the population of each of the six clans.

The Yamane (1973) formula for finite population was employed for equal distribution of the questionnaires across the study Area. The Yamane population sample formula for finite population is given by:

$$n = N / (1 + N(e)^2)$$

Where;  $n$  = present population

$N$  = finite population

$e$  = the level of significance (0.5)

A total of 400 copies of the questionnaire were distributed using the random sampling technique. These were administered to farmers and other indigenes of the area.

To know the number of questionnaires to be given to each of the clans, Bourley's (1998) proportion allocation formula was used to get the sample size of each clan:

$$n_h = n \times N_h / N$$

Where:  $n_h$  = number of units allocated in each clan

$N$  = total sample size

$N_h$  = population size of the clan

$N$  = total population

## **5. Method of Data Analysis**

Both descriptive and inferential statistical techniques were employed in data analysis. The descriptive statistical techniques include the use of tables, figures, etc to present data collected from the respondents. The inferential statistics involved the use of t-test to determine if there was a significant difference in bio-diversity loss in Ini Local Government Area due to agricultural activities. Also Pearson's Product Moment correlation analysis was used to determine the relationship between agricultural activities and biodiversity presence in Ini Local Government Area.

For hypothesis (1), t-test was used to determine if there was a significant difference in bio-diversity loss in Ini Local Government Area due to agricultural activities. Where bush burning represents Site1, bush clearing Site2 and soil tillage Site 3. Furthermore, the hypothesis was tested at 0.5 level of significance and the decision was taken on the result.

For hypothesis (2), Pearson's correlation was used to determine the relationship between agricultural activities and bio-diversity presence.



## **6. Findings**

### **Hypothesis 1:**

There is no significant variation in biodiversity loss as a result of diverse agricultural practices.

To test this hypothesis, the student's t-test was used. The formula is given as;

$$S_x = \sqrt{0.6667/2} = -0.57$$

$$S_y = \sqrt{0.67/2} = -0.58$$

Applying the formula yielded 174.47 as calculated value.

$$D/F = N_x + N_y - 2 = (3+3) - 2 = 4$$

$$4 \text{ at } 0.05 = 2.78$$

Since the calculated value was higher than the table value, the  $H_0$  was rejected, indicating that there was a very strong positive relationship between biodiversity loss and the varying agricultural practices.

**Hypothesis 2:** There is no relationship between agricultural practices and flora biodiversity loss.

This was tested using the Pearson's correlation. With the formula;

$$S_X = \sqrt{0.6667/3} = -0.45$$

$$S_Y = \sqrt{0.001/3} = -0.02$$

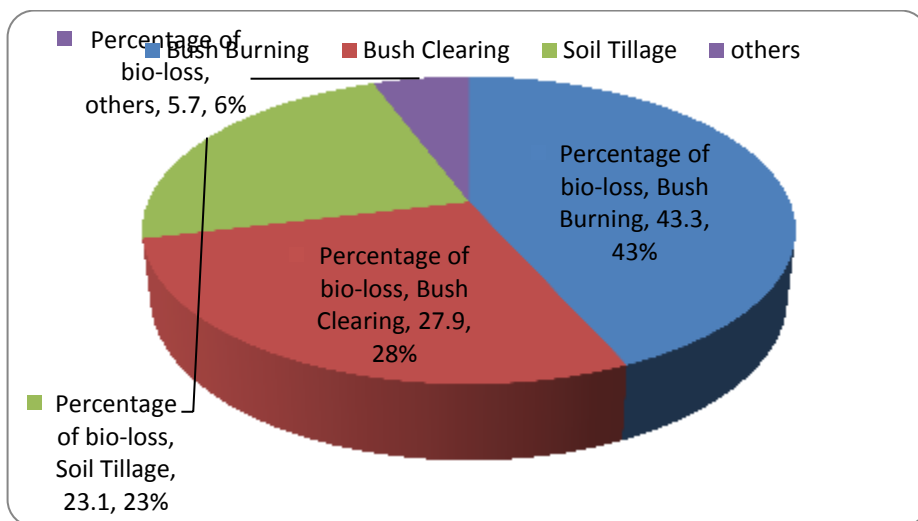
Inserting it in the formula =  $r = 1$ .

This indicated a very strong positive relationship between agricultural practices and flora biodiversity loss.

## **7. Discussion of Findings**

From the 386 copies of the questionnaire collected, the analysis showed that 46% of respondent were male and 53.1% were female. This showed a balance in both sex participation in agricultural activities in Ini Local Government Area. For age of respondents, the study revealed that 25% were below 20 years, 42% were between 20 and 35 years, 26.2% were between 36 and 50 years while 6.7% were above 50 years. Educational distribution of respondents showed that 5.4% had no formal education, 9.6% had primary education, 47.2% had secondary education and 37.8 had tertiary education.

From the analysis, the study identified bush clearing, bush burning and soil tillage as the major agricultural practices in Ini Local Government Area, Akwa Ibom State. Further findings showed that bush burning was usually practiced once in a year (i.e. early planting), bush clearing and soil tillage were usually practiced twice in a year (i.e. early planting and late planting). Of these practices, bush clearing contributed about 27.9%, bush burning 43.3%, soil tillage 23.1% and others 5.7% respectively to biodiversity loss through agricultural practices in Ini Local Government Area, Akwa Ibom State, Nigeria.



**Percentage of bio-loss due to the varying agricultural practices.**

### **8. Conclusion and Recommendations**

Rapidly increasing human populations has brought about an increase in the demand for food which has resulted in the ever increasing agricultural activities and these activities have brought about extensive land use changes throughout the world even in Ini Local Government Area. From the data collected and analyzed, it was clear that agricultural practices caused great harm to our local environment, forest which forms the greatest pillars of life on earth and their destruction inevitably lays the foundation for the alteration of life on earth has been greatly tempered with due to agricultural practices. It was therefore suggested that the use of sustainable agricultural practices for agricultural activities is the way forward for the conservation of flora biodiversity in Ini Local Government Area, Akwa Ibom State, Nigeria.

Based on the research findings, the following recommendations were made:

Farmers should leave some areas of land untouched. For example, neighboring farmers might be encouraged to protect adjacent areas of their farms, so that wildlife corridors that connect natural habitats are maintained or farmers might allow uncultivated areas to exist around, and within cultivated ones. This would allow grasses and other wild plants grow and it can go a long way towards conserving biodiversity.

Farmers in Ini local government should be educated and encouraged to adopt the conservative agricultural practices that will reduce biodiversity loss, like to develop farming techniques that use fewer chemicals. Modern agriculture relies on a high level of chemical input. These include fossil fuels to drive machinery, chemicals to kill weed as well as chemical fertilizers, pesticides and herbicides and all of which affect the ecosystem biodiversity.

Furthermore, policies governing the agricultural sectors, the use of natural resources, protection and conservation of endangered species, habitats and biodiversity need to be aligned to better protect the environment and reduce the ecological footprint of agriculture.

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