

## Promoting Sustainable Community-Based Natural Resource Management in North-Western Nigeria

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### Abstract

The threats of desertification and desert encroachment in the semi-arid north-western Nigeria, have prompted the establishment of several projects aimed at encouraging sustainable management of natural resources in order to protect and stabilise the environment. The projects, while emphasising tree planting (or afforestation), have not given sufficient attention to other soil and water management measures. The projects have also not succeeded in mobilising local communities for sustainable management of resources. Consequently, their impact on the environment of the area has been insignificant. As a contribution towards reversing the situation, this study demonstrates how to use tree planting, soil and water conservation and sensible exploitation of the natural resources, in a holistic manner, to achieve a sustainable environment. It is argued that mobilisation and empowerment of the local communities for sustainable natural resource management is crucial to any environmental protection strategy in the area. Some of the suggested measures for achieving this include ensuring community agreement and commitment before introducing the strategies, introducing only cost-effective measures, organising communities into village associations and/or discussion forums, providing appropriate legal framework, promoting use of indigenous knowledge and institutions, ensuring equitable access to resources and adopting integrated approach to resource management.

### Introduction

The issue of sustainable management of resources has received considerable worldwide attention in recent times. In Nigeria, evidence of this attention is seen in the establishment of federal and states ministries of environment, establishment of an ecological fund, mounting of annual tree planting campaigns, signing of several international conventions on environment and establishment of environmental protection projects, often in collaboration with donors and non-governmental organizations. In north-western Nigeria (consisting of Sokoto, Kebbi and Zamfara States), apart from the ministries of environment in the three states, a number of projects, such as the Sokoto Environmental Protection Project, Zamfara Environmental Protection Project and Forestry II Project, have been attempted in collaboration with foreign donors, in recent times. Under these projects, shelter belts establishment and other tree planting activities have been undertaken. In addition, the projects and the ministries of environment have attempted to encourage rural farmers to plant trees by distributing tree seedlings to them free of charge or at highly subsidised rates. All these attempts are geared towards protecting the environment and achieving sustainable management of natural resources.

There are genuine reasons for the concern about the environment and natural resources of north-western Nigeria. First, the area, particularly the northern part, lies on the fringes of the Sahara Desert and the threats of both desert encroachment and desertification are real. Second, there is concern for the declining productivity of natural resources, particularly arable land and vegetation, largely due to destructive farming practices and over-exploitation of the vegetation resources. Third, the frequency of droughts is increasing and rainfall is becoming more erratic. And fourth, economic as well as medicinal plants are fast disappearing.

It is apparently to reverse these adverse trends, that efforts are being made by governments and donors in the area to protect the environment. However, these attempts seem to have some caveats which have contributed to their ineffectiveness. The first of these is the seeming overemphasis on tree planting (afforestation) almost to the neglect of other soil and water conservation measures. The second problem is that the projects are not participatory in nature. They have failed to effectively mobilise local communities for popular participation in natural resource management. But effectively combatting the degradation of the fragile environment of north-western Nigeria would require more than mere establishment of shelter belts and distribution of seedlings as currently practised. Unless, the communities which use and exploit the resources are themselves organised and encouraged to manage the resources in a sustainable manner, any environmental protection strategy would not stand much chance of success.

This study, therefore, examines how communities in north-western Nigeria could be organised to employ tree planting and other soil and water conservation practices in managing natural resources for their own benefits and for the benefits of future generations. The specific objectives of the study are:

- (i) to describe the physical environment of north-western Nigeria,
- (ii) to identify strategies that could be adopted to sustain and/or regenerate the resources in the area, and
- (iii) to suggest ways of effectively mobilising rural communities in sustainable resource management.

### The Physical Environment of North-Western Nigeria

The area referred to as north-western Nigeria in this study lies within latitudes 10°8'-14°N and longitudes 3°30'-7°10'E, and covers a land area of 102, 535 km<sup>2</sup> (FOS, 1989). Annual rainfall varies from less than 500 mm in the extreme north to about 1,000 mm in the southern fringes, and extends from around May to September. Rainfall during the short rainy season, though the frequency may low, is usually quite heavy, causing erosion of the usually unprotected soil (Agyepong, 1984).

The rainy season is usually followed by a protracted dry season during which little or no rain is received. A major part of the dry season is characterised by strong dust-laden harmattan winds which cause severe wind erosion and lead to the accumulation of sand dunes. In the far northern part of the area, sand dune accumulation could be so severe as to threaten the very existence of some communities. For instance, in 1985, some communities in Illela and Gwadabawa Local Government Areas of Sokoto State had to abandon their homes when sand dune deposition submerged their homes and roads (Okoro and Ipinjolu, 1990). The mean monthly temperature varies from 13°C in December through February to 38°C in April and May, while the relative humidity varies from as low as 10% in February to as high as 90% in August (Moco, 1981).

The vegetation of the area is savanna, with the boundary between Northern Guinea and Sudan savanna cutting across the centre. The extreme north of the area, also exhibits Sahel characteristics. The vegetation generally consists of a few scattered trees and grasses which cover only 30% of the ground surface (Oboho, 1986). The remaining area is bare ground interspersed with rocky out-crops and sand dunes.

These climatic and vegetation characteristics typify a fragile semi-arid environment. In fact, Nest (1991), while noting that the area lies on the fringes of the Sahara Desert, classified 65% of the area as heavily prone to ecological degradation. Arnborg and Singh (1982) similarly characterised the long dry period in the area as "seasonal desert". Inadequate water supply and the concomitant scanty vegetation cover are the most important natural threats to sustainable resource management in the area. Therefore, efforts aimed at sustaining or regenerating natural resources in the area must address water supply and improve ground cover.

But it should be quickly added, that the effects of these natural predisposing factors are worsened by human activities in the area. The most important activities accentuating environmental degradation are arable farming, livestock grazing and fuelwood extraction. Majority of the inhabitants of the area are arable crop farmers and farming is both intensive and extensive. It is intensive because cropping is continuous and extensive because population pressure is extending cultivation into areas hitherto uncultivated. Even forest and grazing reserves are fast disappearing under the pressure of the expanding arable farming. Crop farming practices in the area usually involve almost entire destruction of the natural vegetation and its replacement with annual crops, which when harvested leave the ground surface bare and exposed to agents of land degradation. The farmers practice limited soil or water conservation. In fact, even the weeds and crop residue are often removed to feed livestock or grazed *in situ* giving limited room for organic matter to return to the soil. Although farmers may apply animal manure, this is often in insufficient quantity to sustain soil fertility.

A major proportion of the people in the area also raise livestock largely by grazing animals in the open natural range. There is usually the problem of acute feed shortage particularly during the protracted dry season, which has often led to overgrazing and the accompanying land degradation. In a desperate attempt to provide feed for the animals, livestock rearers also resort to lopping and pollarding of trees. These practices are so severe that the very survival of some tree species is threatened.

Another serious threat to tree survival in the area is cutting down of trees for firewood. About 80% of the population of the area rely on fuelwood for cooking (NEST, 1991). Even tree species such as neem (*Azadiracta indica*), which were originally spared are now cut down for fuelwood (Awodola and Oboho, 1991). This practice over the years has depleted tree population. In fact, as far back as 1984, it had

been estimated that only about 10-20 tree stands could be found on a hectare of land and that some fields had none (Arnborg, 1984). The situation has worsened since Arnborg wrote.

It is evident from the foregoing, therefore, that human activities have promoted ecological degradation in an already fragile natural environment. Measures are, therefore, required to ensure sustainable management of the resources in the area and/or regeneration of those that are already degraded.

#### **Strategies for the Sustainable Management of Natural Resources in North-Western Nigeria**

While man has imposed undesirable and often unexpected changes on the environment, he often has the capacity to modify the rate of such changes and sometimes even to reverse them. Experiences elsewhere have shown that eco-restoration is possible even in highly degraded lands and that such restoration can regenerate local economies and alleviate poverty in a sustainable and cost-effective way (Agarwal and Narain, 1999). But it is important that eco-restoration strategies are designed with full participation of the local communities and *managed* by them. Strategies that could be adopted for sustainable management of natural resources in north-western Nigeria could be discussed under the headings: (1) soil and water conservation, (2) tree planting and (3) moderation in the exploitation of environmental resources.

#### **Soil and Water Conservation**

In the fragile semi-arid ecology of north-western Nigeria, water is probably the most critical and limiting natural resource. The effective utilisation of other resources, including land and human resources, is hampered by inadequate water supply. The success of most other eco-restoration strategies, including tree planting, also depends critically on water availability. In fact, one of the most important obstacles to the success of tree planting drive in the area, has been inadequate water for nurturing tree seedlings particularly during the usually protracted dry season. Therefore, efforts aimed at ensuring sustainable management of natural resources in the area should start with ensuring effective management and utilisation of available water. Curiously, environmental protection strategies in the area, while focussing on tree planting, have not addressed how local communities could conserve water from the period of relative abundance (rainy season) to that of scarcity (dry season). While it is true that a few large-scale dams have been established in the area, the benefits of such schemes (usually imposed on local communities) are not only location-specific, but are also unsustainable.

Closely related to the problem of inadequate water availability is that of land degradation, caused largely by wind and water erosion, continuous cropping and overgrazing. To reverse the increasing trend in land degradation, water conservation efforts must go simultaneously with soil conservation. Some of the sustainable water and/or soil conservation practices that could be adopted in the area are discussed as below.

#### **Water Harvesting**

Water harvesting is the process of collecting rain water for use at times of water scarcity. Depending on the size and purpose, water harvesting structures could be constructed for individual household use or for use by members of the community. For instance, a plate cistern could be built by a household to harvest and store water for human consumption and other domestic uses. A cistern of desired size could be constructed out of cement plates, local sand and water. This technology is inexpensive and is used widely in semi-arid areas of Brazil (Soccal, 2000). Also, at the individual farm level, water can be harvested in micro-catchment tanks made by digging rectangular ditches of required size in the ground, lining them with cement or plastic material to prevent seepage and directing run-off water into them. This technology has also been used widely in central America where it is known to store water for up to six months (Lopez and Bunch, 2000). The stored water could be used for irrigating crops and trees and for livestock watering.

Bigger tanks or reservoirs could be built by a community as a common resource for use by the members of the community. Building such structures would require cooperation of most members of the community and the community has to select the best location for catching the run-off. In India, a reservoir locally known as *Johad* (a structure bound on three sides by natural slope and on the fourth side by a constructed mud barrier) and check dams built temporarily across stream beds have been used (Padre,

2000). But depending on the terrain of the place, any inexpensive structure that could lead to impounding and storage of run-off water could be built. Such impounded water could be used for different purposes including irrigation, domestic use, orchard development and watering of livestock, by community members.

#### ***Infiltration Pits***

Both water harvesting structures and pits have the objective of preventing the loss of rain water. But while in the former case, water is stored for use, in the latter case water is caught in pits to enhance infiltration, thereby raising the ground water table for use by plants. Individual farmers or communities could dig several infiltration pits on the slope to increase infiltration. Farmers adopting this method in Zimbabwe have found that even if there are only five days of rain in the whole rainy season, the crops reach maturity (Shumba, 2001), suggesting that this could be a cheap means of avoiding crop failure in the increasingly drought-prone environment of north-western Nigeria.

#### ***Vegetative Soil and Water Conservation***

This method aims at preventing soil erosion and loss of rainfall moisture by using plants. Of all plants, the use of Vetiver grass (*Vetiveria zizanioides*) has been found to be highly suitable. Regarding the utility of the grass in soil and water conservation, Grimshaw (2001) wrote:

There is overwhelming evidence that properly established Vetiver hedgerows will reduce soil loss to acceptable levels (< 3 tons/ha) and rainfall runoff by as much as 70% depending on the slope and soil type. Soil moisture content is improved, and crop yields, particularly on shallow soils in dry years, have increased by as much as 30%. There is a clear correlation between Vetiver hedgerows and ground water recharge. Where Vetiver leaves have been used on adjacent orchard crops...there have been dramatic increases in soil organic matter (from 0.04% to 1.8% in two years, plus significant increases in N, P, K and other minor elements).

He further noted that the technology is inexpensive, easy to adopt without risk and can be used by small communities without depending on official or formal institutions. These attributes, together with the fact that once established the hedges can last for several years into the future make the technology a sustainable one and commends it for widespread adoption in the nutrient-depleted and all but degraded dry lands of north-western Nigeria.

Curiously, the promotion of the Vetiver technology has not received sufficient attention from agencies concerned with environmental protection in the area. Although some attempts were made by the World Bank-assisted Agricultural Development Projects in the area in the late 1980s to introduce a similar grass (*Vetivera nigratana*), these attempts were half-hearted and have not translated into widespread adoption of the technology. Emphasis seems to be on engineering techniques of soil conservation which are more expensive and are unsustainable. But the promotion of widespread adoption of the Vetiver technology has the potential for tremendously reducing land degradation in the area.

#### ***Soil Fertility Management***

Maintenance of soil fertility under continuous cropping as practised in north-western Nigeria, requires fertilization. With the current nature of supply, distribution system and pricing, inorganic fertilizer is practically out of the reach of most resource-poor farmers in the area. Even if it were readily accessible to the farmers, it is known that continuous use of inorganic fertilizers is ultimately harmful to the soil and the environment, which makes it unsustainable. Therefore, the use of organic manure should be more reliable than inorganic fertilizers. But in the area, the farm is virtually "swept clean" as crop residue and even weeds are removed or grazed, leaving limited chances of the organic matter returning to the soil. Farmers in the area apply organic manure but this is usually in insufficient quantities. However, agricultural development agencies in the area should examine the possibility of utilising some of the abundant solid wastes from urban settlements for soil improvement. It has been suggested that one possible way of doing this is to turn them into organic fertilizers (Asawalam and Chukwu, 2000).

### **Tree Planting**

Tree planting is one strategy that has received considerable attention from environmental protection projects in the area. These projects have attempted to "recloth" the ground surface by establishing shelter belts and distributing tree seedlings to the local population for planting. In spite of these efforts, however, little progress has been made in terms of the area covered. For instance, NEST (1991) estimated that only 3,528 ha of discontinuous shelter belts have been established in the area since 1967. This dismal performance might have resulted from the "top-down" approach of the projects. Sufficient efforts have not been made to mobilise and organise the rural communities for full participation in the projects. In addition, the problem of water scarcity has not been addressed, leading to low survival rates of tree seedlings. Three community-based tree planting strategies that could be emphasised in the area are discussed as follows.

#### ***Promotion of Village Woodlot or Orchard Establishment***

Individual farmers or community as a group may own lands which are not suitable for arable cultivation. Members of the community as individuals or groups could be encouraged to develop such lands into woodlots or orchards. In addition to providing seedlings, environmental protection agencies or projects could support the communities by providing fencing wires and technical advice on orchard establishment. Water for irrigating the trees could come from any of the water harvesting structures earlier discussed. If the tree species are carefully selected, the orchard or woodlot could provide fruits, fuelwood and livestock feed, in addition to protecting the land against agents of degradation.

#### ***Promotion of Agroforestry***

Agroforestry involves incorporating trees on crop lands. There are several patterns in which trees could be planted among crops. But the pattern chosen and the tree species planted should be based on the declared interest of the farmer in question. Needless to say that such species must be of economic value to him. A tree population of between 40 (Ahuja and Mann, 1975) and 100 (Arnborg, 1985) stands per hectare has been recommended for successful agroforestry in the area.

#### ***Homestead Tree Planting***

To further promote the culture of tree growing, communities could also be encouraged to plant trees at home. Trees could be used to replace or at least complement mud wall or local fence (*zana*) which the local populace currently use to protect houses against wind storms.

#### **Moderation in the Exploitation of the Environment**

Sustainable natural resource management could be enhanced through moderate exploitation as against over exploitation of environmental resources. Some of the ways by which this could be achieved are highlighted in the following sub-sections.

#### ***Reduced Extraction of Fuelwood***

As earlier indicated, excessive fuelwood extraction for cooking is a major cause of deforestation and the accompanying degradation in the area. Reduced cutting down of trees for fuel would therefore, reduce the rate of ecological degradation, other things being equal. But to reduce fuelwood extraction, a substitute fuel type or a more efficient utilisation of fuelwood is required. Given the high and increasing cost of kerosene and gas, as well as absence of electricity in rural communities in the area, it is difficult to proffer an alternative to fuelwood use as at now. However, it is quite feasible to promote the use of more efficient woodstoves some of which have been developed by the Sokoto Energy Research Centre, but the widespread adoption of which has not been aggressively promoted. These stoves have the potential of considerably reducing fuelwood requirements of households. If the community tree planting culture is adopted, the reduced fuelwood requirements might even be met by pruning planted trees as against cutting down whole trees in the fields.

#### ***Avoiding Over grazing***

Over grazing exposes land to degradation and pollarding causes the death of some trees. If

farmers, including livestock owners, are able to store water all year round, they could be encouraged to raise some pasture for feeding livestock in addition to obtaining some forage from planted tree species. This should reduce the grazing pressure on the natural range, particularly during the dry season.

#### ***Alternative Income Sources and Poverty Alleviation***

Environmental degradation tends to be linked to poverty (Eboh, 1995; Tuboly, 2000). In other words, the more poverty-stricken a group of people are, the more they are likely to over exploit the resources available to them. This is particularly so for rural communities in north-western Nigeria, where farming (arable and livestock) is the primary source of income and livelihood. With increasing population, there is the tendency towards over-exploitation of natural resources as people strive to sustain their livelihoods, leading to degradation. With degradation comes decline in productivity and this threatens survival. As survival is threatened, exploitation is further intensified and even resources usually left to regenerate are no longer spared, leading to further degradation, and the process continues. Poverty and environmental degradation, it seems, are mutually reinforcing.

Therefore, it may be possible to reduce environmental degradation by alleviating poverty and/or providing alternative (non-farm) income sources in rural north-western Nigeria. According to Eboh (2000), one of the surest routes out of poverty for millions of rural farming households in developing countries, is the diversification into non-farm employment. He listed the categories of non-farm activities as manufacturing and cottage industries; public and private services; commerce, trade and transportation; as well as construction and artisan works. Certainly, not all of these activities may be suited to all communities. But government or other relevant agencies could examine the resource endowment, comparative advantage and other socio-economic variables of a community before deciding what type(s) of non-farm employment to promote there. Given the nature of rural communities, government support would particularly be required in the areas of infrastructural development, training and capital provision in order to build a vibrant non-farm rural economy capable of providing alternative livelihoods to people in the communities.

#### ***Discouraging Bush-Burning***

Bush burning is a serious problem not only in the study area but in the country generally. Hunters, pastoralists and even farmers for different reasons are known to deliberately set bush or farm on fire. This practice is not only harmful to most flora and fauna in the ecosystem, but it also leaves the soil surface exposed to water and wind erosion. It is difficult for any outsider to keep surveillance over the wide expanse of land, but the community could be mobilised to do so and to sanction offenders.

#### ***Mobilising Communities for Sustainable Natural Resource Management***

One of the key recommendations of the United Nations Convention to Combat Desertification (UNCCD) was that local communities should play more active and recognised role in the management of their environments (Deme, 1998). This emanated from a growing body of empirical evidence to suggest that local people are more likely than the state to manage natural resources in a responsible way because their livelihoods depend on it (Swift, 1991; Cousins, 1996; Winter, 1998; all cited in Hesse and Trench, 2000). But an equally important premise for involving the local communities, is that successful sustainable management of natural resources depends, among other things, on the extent and manner in which the resources are exploited. Therefore, any attempt to manage natural resources without the involvement and cooperation of those who exploit these resources would have little chance of success. This fact is demonstrated by the failure of most attempts by some states in Africa to regulate the exploitation of resources through centralised state administrative and legal machineries (Deme, 1998; Gueye, 1999; Hesse and Trench, 2000).

Against this background, it should be emphasised that the natural resource management strategies discussed in the preceding section would work effectively only if the communities are effectively mobilised to adopt them. Some of the imperatives for successfully mobilising local communities for participation in sustainable natural resource management strategies in north-western Nigeria are discussed as follows.

### **Wait for Agreement**

People participate effectively in a project if they perceive benefits in it and see it as theirs. Therefore, in introducing a natural resource management strategy, the guiding principle should be: *participate in your project for your own good* rather than *participate in my project for your own good*. In introducing a project or practice, such as the soil and water management strategies earlier discussed, the community should first be sensitised to its benefits and encouraged to discuss its merits, demerits and feasibility for as long as it takes to reach a general agreement. The ultimate decision as to whether or not the project is required should rest with the community. If it eventually decides to go ahead with the project, the community should provide some of the inputs, such as labour, project site and other inputs that are easily within their command, while the agency promoting the project should supply the external inputs. Accepting to make contributions towards the project is further proof of the community's commitment to it.

### **Measures Should be Cost-Effective**

Eco-restoration or natural resource management measures should be cost-effective, replicable and sustainable. In other words, the measures should be those that the local people could afford and the benefits should exceed the costs (both of establishment and maintenance). Furthermore, to facilitate spread, they should be such that other members within or outside a community could reproduce and they should last for considerable time. These attributes would provide incentives for quick adoption of the measures (Zaal *et al.*, 1998).

### **Organise Communities into Associations and/or Forums**

The communities should be organised into village associations and/or discussion forums which could take decisions on management and establish laws or regulations governing the exploitation of natural resources. Such groups should actively promote open discussion and should be organised along democratic lines to ensure popular participation. Group pressure would ensure that decisions taken are binding on members. The associations could make arrangements for surveillance over the village resources to check over-exploitation or other forms of abuse. They could also be effectively used when group action is necessary, as in the case of constructing community water harvesting/soil conservation structures, planting village orchards and other measures earlier discussed.

### **Provide Appropriate Legal Framework**

There is the need for governments in the area to officially devolve the power and responsibility of managing resources to the communities. For instance, the control of grazing reserves, forest reserves and even land ownership generally rests with governments in the area. The governments have very detailed laws and regulations governing the use and exploitation of these resources. However, these are hardly followed and the resources are being depleted at a fast rate because of governments' inability to effectively regulate their use. Giving the communities in whose territories the resources fall, the power to regulate their use and manage them would enhance their sustainability. The communities should also have the power to punish members or outsiders who violate community-established rules for exploitation or use, such as cutting down of trees, overgrazing or grazing protected vegetation, encroachment into livestock movement corridors, unwise use of water etc.

### **Promote Use of Indigenous Knowledge and Institutions**

Local communities are known to have vast indigenous knowledge in various fields, including farming and resource management. Furthermore, people accept new ideas more readily if they are similar to those already institutionalised. Therefore, before introducing new measures aimed at improving natural resource management, attempt should first be made to study the indigenous natural resource management practices and to see if they could be strengthened or improved upon. Similarly, communities may already have some resource use regulating institutions. Hence, it would be instructive to establish what these are, and to see if what is required is to strengthen them, rather than impose new ones.

### Ensure Equitable Access to Resources

Most communities in the area would likely consist of the rich and the poor, permanent and temporary residents, men and women, as well as farmers and pastoralists. To avoid conflicts which could threaten sustainable management, equitable access to resources should be promoted. This could be ensured by encouraging adequate representation of the various interest groups on the decision-making organs such as the discussion forums and village associations earlier proposed or any other medium where decisions on resources development, use or exploitation are made. In the case of women, the culture of the area may preclude their participation in forums where men are present. However, they could still be represented by male proxies.

### Adopt Integrated Approach

It has been rightly observed that the "village ecosystem" usually consists of several integrated components: crop lands, grazing lands, forests and trees, local water bodies, livestock and various energy sources (Agarwal and Narain, 2000). The role of any sustainable resource management or eco-restoration project should be to simultaneously develop all components. In other words, the approach should be holistic rather than fragmented or sectarian since, as Agarwal and Narain (2000) pointed out, what happens in one component invariably impacts on the others. Besides, selective development or restoration of some components, leaving others, would not assure cooperation of all the interest groups and this cooperation is essential for their sustainability. That is, the negative action of just one group could jeopardise the success of an entire project. In view of this, most of the strategies for sustainable natural resource management earlier suggested should be pursued concurrently.

### Conclusion

Attempts at promoting sustainable management of natural resources in north-western Nigeria, seem to have mainly emphasised tree planting (afforestation) by both the projects and local communities. This paper has argued for equal attention to other strategies of sustainable natural resource management such as soil and water conservation measures and effective mechanisms for achieving moderation in the exploitation of environmental resources. Some of these measures are in fact, essential for the success of the tree planting drive itself. The paper therefore, proposed a holistic approach, combining several strategies for achieving sustainable management of the resources. The paper also emphasises the promotion of active involvement of the local communities and granting them the full power for the management of the resources. Unless members of the communities who use the resources are successfully mobilised to manage them in a sustainable manner, solution to the problem of environmental degradation in the area will remain elusive.

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