



Nubian Vault buildings for agriculture and livestock

**An opportunity for rural
development**



The agriculture and livestock sectors, engines of growth for Africa

In most African countries the agricultural sector is an essential part of the economy, especially in terms of production and employment.

However, the lack of appropriate infrastructure has many negative impacts on working conditions and productivity, and especially on the growth of the sector. This worsens the already fragile conditions of farmers and pastoralists confronting natural risks and the impacts of climate change.

The Nubian Vault concept promoted by AVN and its partners is an architectural technique which involves neither timber nor tin/zinc roofs, the many advantages of which can answer the needs of the agriculture and livestock sectors while supporting dynamic local development.

"Improving the resilience of agricultural systems is a priority"



"The spread of adapted crop storage barns would guarantee availability almost throughout the whole year, stabilising the cost of foodstuffs and reducing food imports, thus enhancing the self-sufficiency of the population whilst at the same time creating local jobs and a skills base."

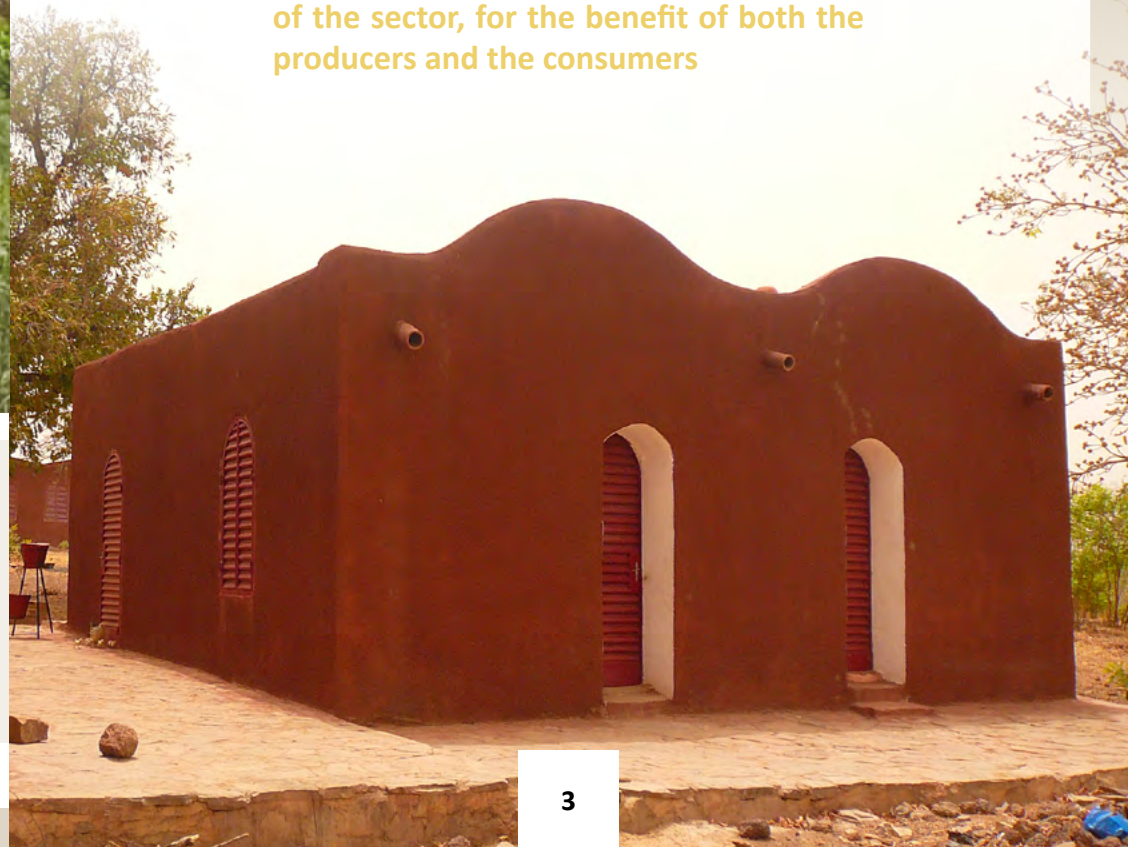
Moïse Napon, President of the Economic and Social Council of Burkina Faso

Adapted buildings, a necessity for strengthening the sector

The strategic orientations of States and the UN in favour of food security and the improvement of self-sufficiency also recommend the construction of buildings which provide:

- ▶ **greater protection from natural risks (storms, wind, etc.)** compared to ill-adapted tin-roofed buildings
- ▶ **better conditions for housing livestock**
- ▶ **better conditions for stocking and conserving foodstuffs** and strengthening food self-sufficiency
- ▶ **better working conditions** for farmers and pastoralists

➔ **There is a need for a definitive solution for the sustainable development of the sector, for the benefit of both the producers and the consumers**



The Nubian Vault concept: a solution for farm and livestock buildings

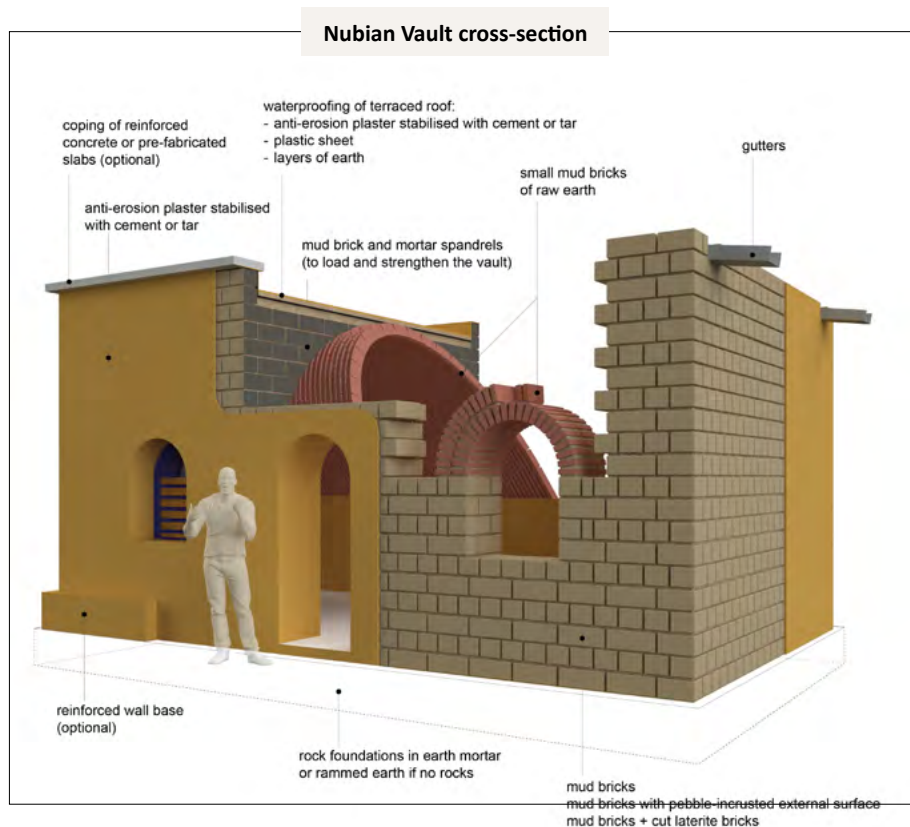
Buildings without timber or tin roofs with a constant temperature

The Nubian Vault (NV) is an ancient architectural technique with its origins in the Upper Nile region, providing comfortable and modular buildings with modern, solid, vaulted roofs which can be constructed **with a basic tool kit and locally sourced materials and labour.**

Specifically, the NV concept involves:

- ▶ the use of earth, an abundant raw material, for adobe bricks and mortar,
- ▶ no timber or metal framework for the construction of the vaulted roofs.

The thermal inertia of a NV building (thick mud earth walls and roof) evens out external temperature fluctuations, maintaining a relatively constant internal temperature.



Functional buildings adapted to various uses...

With the Nubian Vault technical concept, buildings can be constructed to match the different uses of the sector:

Storage: for seeds, harvests (for future sale or deferred use), production system, warrantage (a banking procedure managed by a micro-finance organisation), food bank (food security)

Livestock: stable, chicken house, pigsty, etc.

Processing workshops: misola flour, jatropha oil, etc.

Other uses: accommodation for producers, agricultural workers or guards, offices, tool stores, stockrooms, etc.

... and for all the sector's activities



Cereals:
millet, rice, maize, etc.



Livestock:
poultry, cattle, sheep, goats, pigs



Vegetable farming:
yams, onions, tomatoes, etc.



Crops for sale:
cotton, sesame, soy, etc.



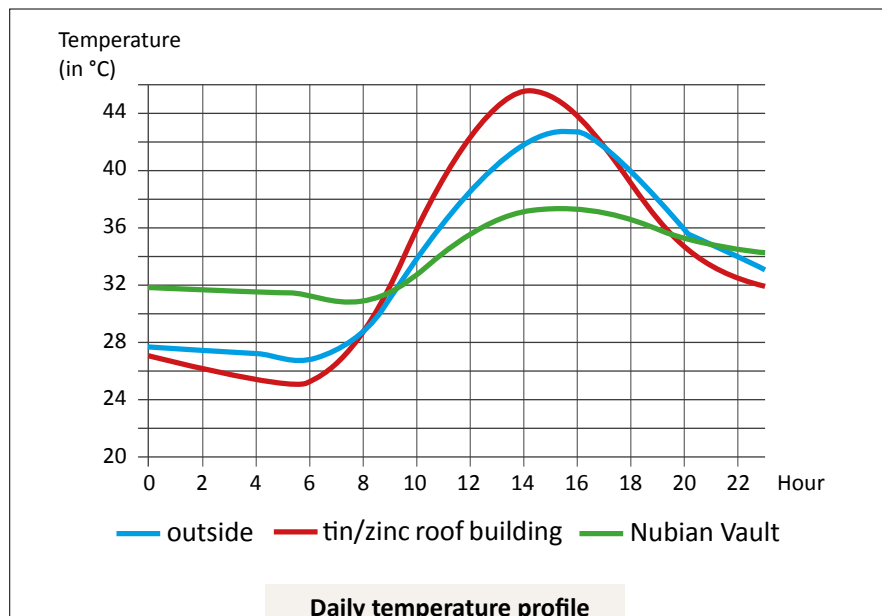
Forestry & orchards:
cashew, shea, mango, etc.

The specific advantages of the NV for the agriculture and livestock sectors

Excellent thermal and humidity inertia

Several thermal measurement studies comparing NV buildings with alternative structures have been carried out since 2007 in Senegal and Burkina Faso. These studies confirm that the variations of temperature and humidity inside a NV building are relatively small:

- ▶ **Cold discomfort is very limited** or non-existent;
- ▶ **Heat discomfort is drastically reduced** compared to a building with a tin roof — it is cooler indoors than outdoors throughout the day;
- ▶ **Humidity levels are better controlled.**



Daily temperature profile

Ngueye Gueye, Senegal, Mars 2015

- ➔ **Adaptation of buildings to the consequences of climate change and reduction of energy needs related to indoor comfort**
- ➔ **Improvement of livestock breeding, food storage and farm labour conditions**



Drying crops on a roof terrace

Greater protection from storms

Thanks to its thick walls and strong roof terrace, a NV building provides **effective protection and significant levels of noise reduction during heavy rain storms and violent winds**, as compared to a building with a flimsy or leaking tin roof.

A comfortable and spacious environment

The NV system is **modular and can be used to create spacious working areas adapted to the diverse functions of the sector**, thanks to the use, for example, of concrete posts and beams to support the vaults over a wider area. And the NV roof terrace provides **extra outside space**, ideal for drying crops.

The general advantages of the NV concept

An affordable cost

The basic cost of a NV can be **up to 50 % less expensive** than alternative, less well adapted construction techniques, especially if the beneficiaries provide the unskilled labour on the site and help bring in the raw materials.

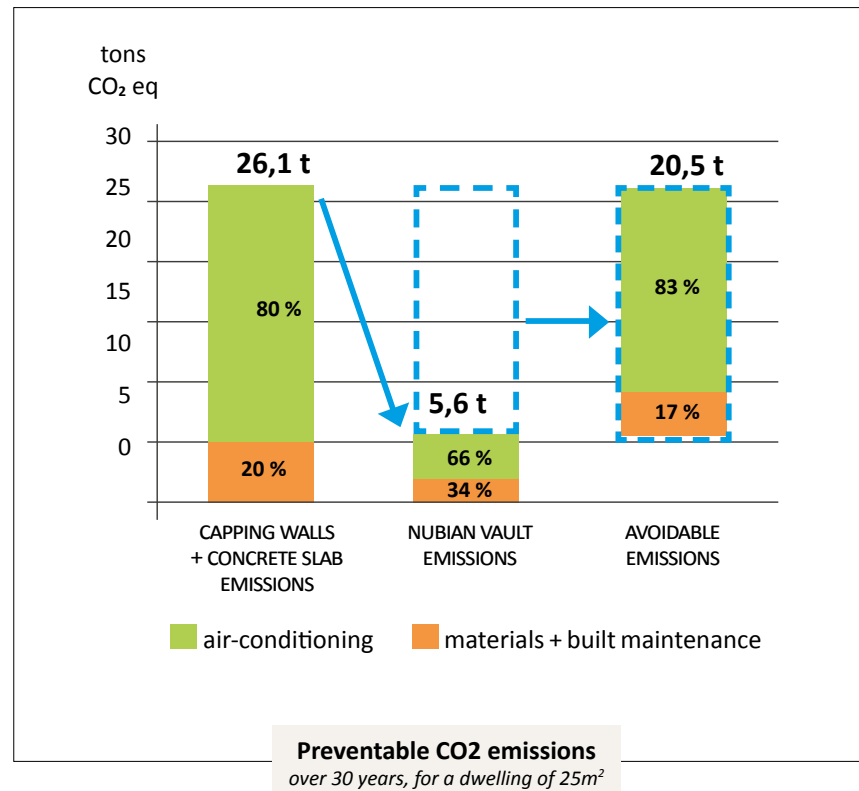
Environmental impacts and attenuation of climate change

Built with locally sourced low carbon materials and non-mechanised procedures, using neither wooden beams nor metal roofing panels, with good passive energy performance, **the NV technique contributes to biodiversity and conforms to national commitments concerning reduction of greenhouse gas emissions.**

Stimulation and reinforcement of local economic circuits

The NV technique involves 'High Intensity Labour' (HIL), **promoting local employment, especially for agricultural workers** out of season, and for youth and less qualified personnel.

Furthermore, the NV technique **helps re-inject construction costs into the local economy** and limits the use of imported materials.



Onion Storage (Burkina Faso)

Specific needs focus

- ▶ **Increased temperatures during the hot season** imply the need to anticipate measures to increase nocturnal ventilation in the planning stage of the building
- ▶ **For community buildings, it is essential to plan, from the start, the necessary finishes to preserve the building** and reduce the need for long-term maintenance.

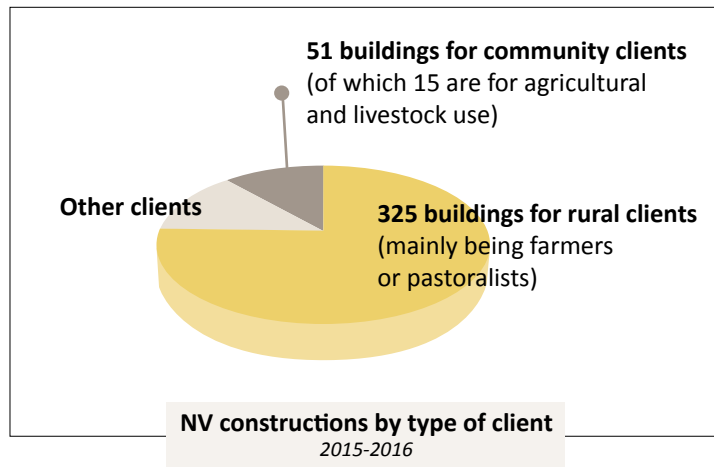


"We got interested in the NV technique because the advantages are enormous. The results are very conclusive. We are convinced that with this technique the farmers will be confident about the constructions and their resilience to climate change.."

Christophe Konkobo, President of the farmers' organisation AKNGS (Burkina Faso)

The agricultural and livestock sector: a significant part of the NV market

The Nubian Vault technical offer can answer the major construction needs of the agriculture and livestock sector. Currently the majority of NV buildings are for private housing, but there are also much larger community buildings.



Since 2000 there have been built*:

→ **1,150 NV houses** for farmers and livestock owners

→ **82 NV buildings** for agricultural and livestock use

**Cumulative figures dated February 2017, for Burkina Faso, Mali, Senegal, Benin and Ghana*



Example of buildings

Production Units



Jatropha oil processing plant (Mali)



Electrified activity area in Konséguéla (Mali)

Example of buildings

Livestock buildings

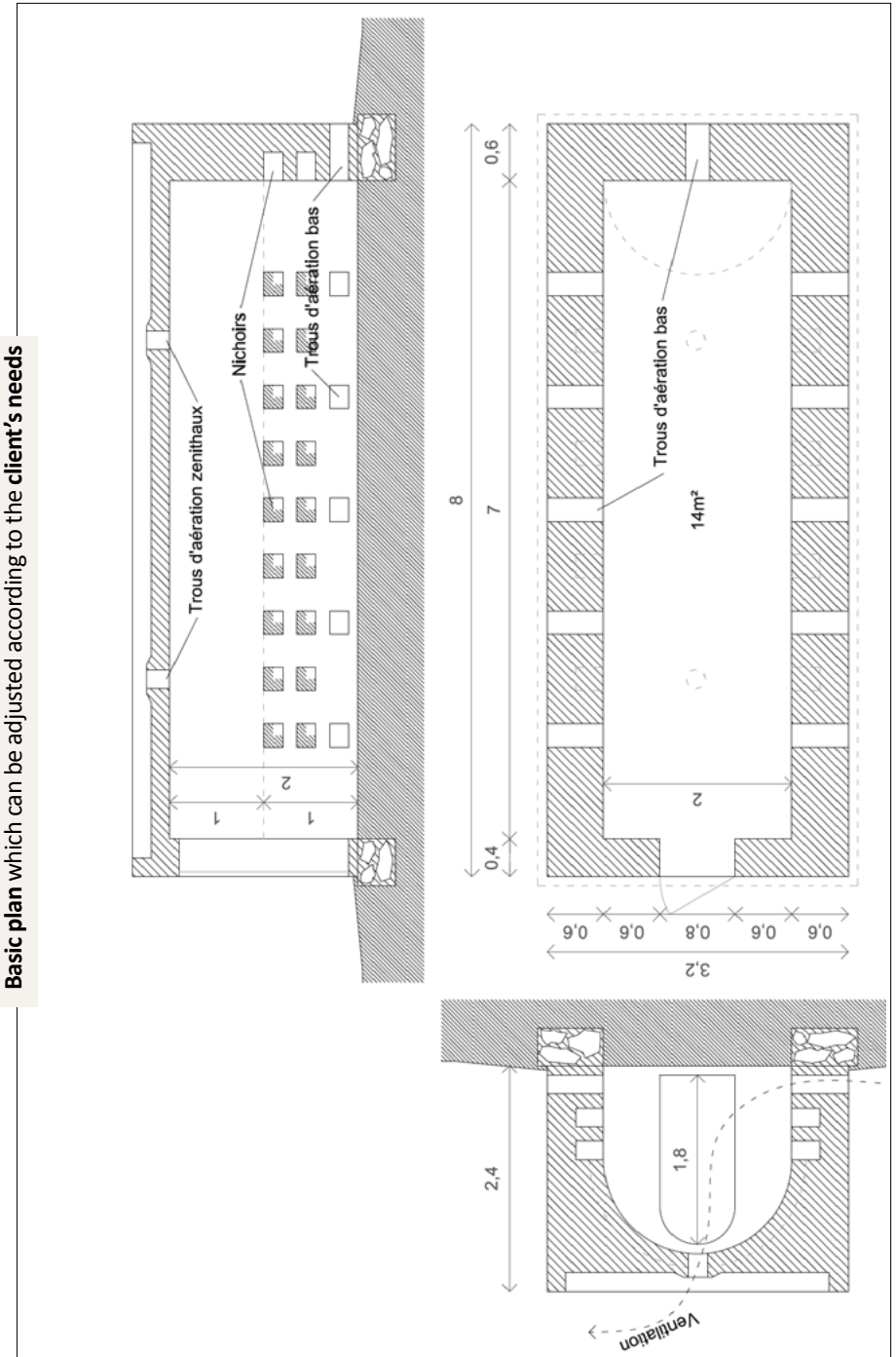


Poulailler en VN

"Before now, my henhouse was made of sheet metal. On the inside, the heat was very unpleasant to my 35 hens, and half of the eggs ended up rotting. Now that I have a Nubian Vault building, my hens enjoy comfortable shelter. There is less heat; there are fewer insect pests; and there are very few losses. The shelter is so much better that every night, I have to shoo away my neighbour's hens from my henhouse! I own today 65 healthy hens and I heartily recommend the Nubian Vault buildings for better animal well-being, and ultimately for better production."

Houdou Bagayoko, farmer (Burkina Faso)

Basic plan which can be adjusted according to the client's needs



Example of buildings

Storage barns



Shallot storage (Mali)



Onions storage barn (Mali)



Cotton storage (Burkina Faso)

Storage barns



Onion storage barn (Burkina Faso)

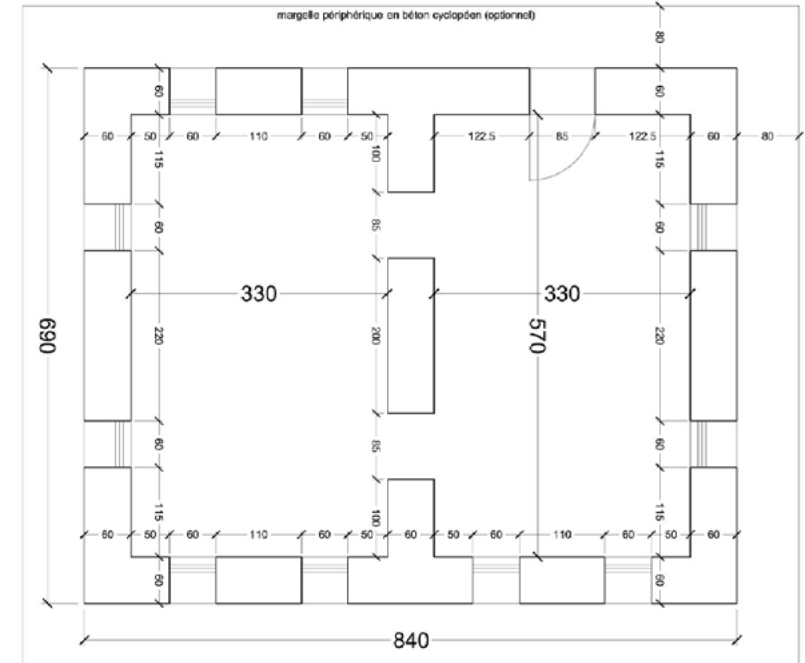
Example of an onion storage barn

Construction of 4 NV buildings for preserving onions as part of the Nutrition and Food Security Programme of Burkina Faso, financed by the European Union and executed by the UN's Food and Agriculture Organisation (FAO).



Awareness meeting with producers (Burkina Faso)

Basic plan which can be adjusted according to the client's needs



Onion storage barn (Burkina Faso)

The Nubian Vault Association

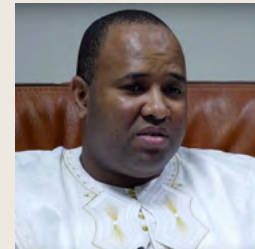
For the last 15 years, AVN has been developing an adapted construction market through the promotion of the **Nubian Vault technical concept in West Africa**. This concept can satisfy a wide range of current needs for both private and community buildings, through the integration of access to affordable housing for as many people as possible with environmental, climatic, training, and employment issues, helping to respond to the many challenges of development of the continent.

AVN is positioned now as a **key operator of appropriate construction in West Africa** as a result of its proved expertise, its active deployment in 5 countries with the support of local partners, and its measurable and growing results.

Building with the Nubian Vault concept also means:

- ▶ benefiting from durable buildings adapted to the challenges of climate change
- ▶ improving families' living and working conditions
- ▶ being trained as a NV mason and getting a job with a future
- ▶ vitalizing local economies
- ▶ taking part in the national development of a green economy

The Nubian Vault, an innovative programme... encouraged by polical actors,



"It is the living and housing standards that contribute the most to the health and well-being of the populations. The Nubian Vault should be supported by the Ministry for Environment and Sustainable Development because it corresponds exactly to our policy for resource management and the fight against poverty."

Abdoulaye BALDE, Minister of Environment and Sustainable Development of Senegal, testimony received in Dakar, 2015

... supported by many financial partners,



...recognized by numerous international awards, especially concerning the environment and sustainable development.



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