AGRICULTURAL PRODUCTION METHODS AND TECHNOLOGY

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G. F. Fanlyi Ph.D

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CHAPTER TEN

GAME PRODUCTION AND UTILIZATION

FATUROTI E, O. & AKINYEMI, A. F.

INTRODUCTION

Games are all forms of wild animals living in their natural environment. Animals can be generally classified as either a big or a small game depending on their body size. The small animals are mainly rodents and these are most feasible for domestication projects; while the duikers are assumed to be the starting size point for the big game.

A Game reserve is defined as an area set aside for the preservation of wildlife and it is managed at the state level eg. Alawa Game Reserve in Niger State, Otukpo Forest Reserve n Benue State and Ifon Game Reserve in Ondo State.

National Parks are areas of land set aside for the protection and preservation of wild animals and their habitats e.g. Yankai

National Park, Bauchi; Chad Basin National Park, Borno; Kanji Lake National Park, Niger and so on.

The term "wildlife" encompasses all living organizations that occur in the wild state.

Classification of Some game animals of Nigeria

Some game animals of Nigeria are classified below:

Order: Reptiles

Common Name	*Scientific name*
Nile crocodile	Crocodylus niloticus
Short-nosed crocodile	*Osterlaemus tetrapis*
Nile monitor lizard	*Varanus nilopticus*
Royal Python	*Python sebae*
Lizard	*Agama spp.*
Turtles	*Tuatara spp.*

Order: Aves (Birds)	
Common name	*Scientific name*
Ostrich	*Struthio camelus*
Guinea fowl	Family-Numidae
Egrets	Family-Ardeidae
Parrots	Family-Psittacidae
Sparrow-Hawks	Family- Falconidae
Secretary bird	*Sagitrarius serpenarious*
Order: Mammals	
The Primates	***Scientific names***
Green monkey	*Cercopithecus aethropus*
Patas monkey	*Erythrocebus patas*
Baboon	*Papio annubis*
Gorilla	
Chimpanzee	*Pan troglodytes.*
Order: Carnivores	
Hyena	*Crocuta crocuta*
Lion	*Panthera leo*
Leopard	*Panthera pardus*
Cheetah	*Acinonyx jubatus*
Jackal	*Canis* spp
Fox	*Felis libyca*
Order: Proboscidea	
African elephant	*Loxodonta africana*
Order : Sirennia	
West African manatee	*Trichechus senegalensis*
Order: Perissodactyla	
Rhinoceros	*Diceros* spp
Order: Rodentia	
Ground squirrel	*Xerus erythropus*
African giant rat	*Cricetomys gambianus*
Grass cutter	*Thryonomys swinderianus*
Brush-tailed procupine	*Atherurus africanus*

Order: Bovidae

Bushbuck	*Tragelaphus scriptus*
Red-flanked duicker	*Cephalophus rufilatus*
Crowned duicker	*Sylvicapra grimmia*
Water buck	*Kobus defassa*
Roan antelope	*Hippotragus aquinus*
Buffalo	*Syncerus caffer*
Kob	*Adenota kob*
Reedbuck	*Redunca redunca*

Order: Artiodactyla

Red river hog	*Potamocherus porcus*
Warthog	*Phacochoerus aethipicus*
Hipopotamus	*Hipopotamus amphibious*

Order: Lagomorpha

Rabbits
Hares

Order: Chiroptera

Bats

Order: Insectivora

Hedgehog
Rock shrew
Grass monge

The most abundant land animals have been shown to be herbivores mostly in orders rodentia, boridae and primates. These are complimented by the orders carnivora and artiodactyla.

The animals that have been widely considered for ranching are Waterbuck (*Kobus defassa)*, Hartebeest (*Acelaphus busaphalus*), Buffalo (*Syncerus caffer*) Warthog (*Phacochoerus aethiopicus),* Eland (*Taurotragus oryx*), Duikers (*Cephalophus)* spp.) and Kobs (*Adenota kob).*

Distinction between non-specialized and specialized production

With the possible exception of Antarctica, almost all terrestrial habitats have evolved to a greater or lesser extent with a human component within it. Therefore, the basic objective of diversity conservation is not between habitat devoid of humans or that populated by them, rather, it is a distinction between different methods of production that result in sustainable harvesting. Table 1 illustrates non-specialized and specialized production.

Table 1: Non specialized and specialized production

Non-specialized production	Specialized production
Diverse species	Single or few species
Minimal capital goods	Substantial capital goods
Little human intervention	Substantial intervention
Non segregation resource	Segregation resource base

The three key facets distinguishing specialized production from non-specialised production are homogeneity, intervention and segregation. Specialization arises when the methods of mass production are applied to natural resources. The mass production of a *single specie* allows for the use of specialized capital goods (machinery, chemicals, bio-engineered seed/animal varieties) that have comparatively high rates of productivity when introduced.

Such *capital goods* require substantial minimum efficient scales in order to be cost effective, both in their own production and in their application. This minimum efficient scale requirement means that only a few species are capable of production on a world wide basis by use of these capital intensive methods. The logical consequence is that only a small number of species provide the bulk of the world's food. For example, of the thousands of species of plants that are deemed edible only 20 species actually produce the vast majority of the world's food (Table 2) (Vietmeyer, 1986). In fact, the five main carbohydrate crops (*wheat, *rice *cassava, *maize and *potatoes) feed more people than the next 15 crops combined (Witt, 1985) (Table 2).

Another consequences of the mass production of a small number of species is the necessity for *continuous human intervention*. The introduction of these species into habitats to which they are not naturally adapted, and especially when intensive domestication or agriculture is being practiced, means that co ..nuous human.

Table 2: Agricultural Crops

Yam
Okro
Melon
Pumpkin
*Wheat
*Rice
*Maize
*Potato
*Cassava
Cocoa
Cowpea
Plantain
Millet
Sorghum
Guinea corn
Cucumber
Carrot
Cabbage
Pepper
Tomatoes

* Five main carbornyhdrates

involvement is required in order to monitor the production process Of course, nature is capable of producing these game species on its own accord through natural processes, but once substantial components of the existing ecosystem are removed and new ones are introduced continuous human intervention is usually necessary. In essence, the displacement of the ecosystem production system from its equilibrium is a commitment to on-going intervention.

Another distinguishing facet of specialized production is the *segregation of the resource base*. Segregation by the clear designation of individual property rights usually accomplished through fencing is often necessary for optimal individual investments. This is because the incentives for optimal individual investment are most cost-effectively conferred by this method. It provides the means by which the expected returns to investment are internalized completely.

The notion of asset ownership is especially important when the investment process is an on-going one. Therefore, segregation and specialization go hand-in-hand when specialized production techniques are introduced into natural habitat. The conversion of land from natural habitat to specialized production is driven by the economic law of specialization and the productivity gains that it promises. However, a clear trade-off exists between productivity and variety under this law. This is because the necessary components of specialized production (homogenization, intervention and segregation) foster the former while diminishing the latter.

Methods available for games utilization

Total economic value comprises direct and indirect use values, option values and existence values. Direct use values include wildlife and other harvested products (e.g. skins, hides, tusks/horns, plants, resins) and direct use of natural areas for tourism and recreation. Indirect use values are essentially the ecological functions of species and natural areas (e.g. protection, microclimatic and material cycling functions). All these values may have an "option value" component if we are interested in preserving them for future use.

Table 3 indicates many *use* and *non-use* values of wildlife and wildlands that may comprise their total economic value (TEV).

Table 3: Classification of total economic value for wildlife and wildlands

Use values		Non-use values	
(1) Direct value	(2) Indirect value	(3) Option value	(4) Existence value
Sustainably harvested products (meat/fish, timber, plants etc)	Ecological functions/ roles	Future uses as per (1), (2)	Biodiversity
Recreation	Protection functions		Culture, heritage
Tourism	Waste assimilation		
Genetic material	Microclimatic functions		
Education	Carbonstore		
Human habitat			
Other services (water transport/ supply).			

Use values

Direct use values are the resources and services provided directly by natural areas or by directly harvesting and exploiting wildlife. Given the multitude of benefits and users it may be very difficult for wildlife managers to actually appropriate the full value of wildlands.

The following hypothetical example briefly examines this problem in the case of wildland producing four types of benefits: (1) direct use benefits; (2) genetic resources values; (3) ecosystem services and (4) existence values. Benefits from the wildland are assumed to go to three broadly representative groups "management", "local" and "global" groups.

The "management" group exerts direct control over the resource. They harvest wild species for a variety of uses and may derive psychological satisfaction from the mere existence of local species and habitat. In addition, they may crossbreed varieties and species, thereby, obtaining value from genetic resources. On-site, ecosystem services may provide support and protection to the daily

activities of the management group. All four of the benefits produced by the wildland are captured by the managers. In this example, it is assumed that these are the only benefits that the management group receives from the resource, and they are not compensated for benefits that other groups receive from the resource.

The second, *"local"* group has no legal access or control over the wildland. Nevertheless, ecosystem services that originate within the wildland may provide off-site benefits to the locals such as watershed protection or groundwater recharge. Similar to the managers, the locals may enjoy existence values originating from the species or habitats of the wildland. It is also possible that the local group may derive benefits from encroachment on the wildland for the purpose of collecting wild species for direct consumption or use in breeding activities. Clearly, the locals may capture some of the economic benefits of this wildland, however, the benefits that accrue to the locals are not captured by the management group.

The final group in this example, the "global" group consists of those living at a distance from the wildlands concerned. Although these people have little direct interaction with the wildlands' resources. They may receive indirect use benefits from ecosystem services that have global impacts and existence benefits from exotic or endangered species with a global appeal. The benefits of genetic resources freely collected from the wildlands may also provide marketable benefits to multinational companies or farmers benefiting from public breeding programmes. Again, these are benefits captured by the global group with no compensation paid to the management group in return.

Indirect use values comprise mainly the environmental functions of natural areas – ecological functions such as nutrient cycling, protection functions, such as ground cover for key watersheds, waste assimilation functions such as the retention or detoxification of pollution and wider functions such as microclimatic stabilization and carbon storage. All these environmental functions indirectly support economic activity and human welfare. However, wildlife species may also have important indirect use value through

key ecological roles. For example, elephants are known to have an essential ecological role in African savannahs and forests through diversifying ecosystems, dispersing seeds, reducing bushlands, expanding grasslands and reducing tsetse fly which is of value to livestock grazing.

Option value relates to the amount that individuals would be willing to pay in order to conserve wildlife and wildlands or at least, some of their direct and indirect applications for future use. Individuals essentially value the guaranteed "option" of future supply of the uses, the availability of which might, otherwise, be uncertain.

Non-use values

Non-use values are those benefits that are completely divorced from the use of a resource. Such benefits occur when people are willing to pay simply for the pleasure they derive from knowing that particular species or habitats continue to exist irrespective of any plans they may have to hunt, observe or otherwise use these wild resources.

Table 3 shows that such non-use values are best characterized as *existence values* which relate to valuation of resources as unique assets in themselves, with no connection to their use values. This would include the worth of wildlife species, natural areas, overall biodiversity as objects of intrinsic and 'stewardship' value and as a unique cultural and heritage assets. As essentially an attribute of natural areas rather than a resource or function, biodiversity has a special value relationship (Aylward and Barbier, 1991). In addition to having existence value, the diversity of biological resources may contribute to the direct use value of a natural and as a source of genetic material. Biodiversity may also have additional indirect use value in protecting ecological stability and functions.

The satisfaction that comes from knowing that a particular animal, habitat, micro-organism, etc; continues to prevail on earth is felt by all who wish to know and care in this manner. Once existence is provided, there is no way to exclude values. The emotional, spiritual or ethical satisfaction derived from existence

value is in no way diminished or affected by the degree of pleasure that others may also derive from a particular source of existence value. Therefore, "consumption" of existence values is both non-excludable and non-rival. Existence value is an example of a "pure" public good.

People in both the developed and the developing world may experience an existence value for the wildlands of developing countries. The suggestion that such values are much larger in developed countries is usually based on the assumption that existence values are a luxury of the rich. This, however, does not necessarily square with the reverent attitude toward nature exhibited by many indigenous forest dwellers and other rural peoples in the developing countries.

Games Production techniques

Since it is impossible to make a sharp distinction between ranching and domestication (Eltringham, 1984), domestication could, therefore, be described in terms of levels (depth). Domestication depends on the species of animals in question,. Similarly, the prevailing land use pattern varies in degree of intensity.

With respect to animals bred by man under artificial conditions three main types of husbandry techniques are identified viz:-

(a) Ranching – Extensive Production

(b) Farming on fenced range – Semi-intensive production and

(c) Pen rearing – Intensive production.

Extensive Production Ranching

The extensive system requires a large area of land where-in herds of animals may live in an uncontrolled environment. The areas are usually not less than 50,000 ha. Generally, herds are large composing of males, breeding females and their young ones.

The production practices in ranching consists mainly of controlling the population of the animals concerned with a view to avoiding overgrazing. The habitat is subjected to minimal rate of manipulation, although, measures such as improvement of water

supply through artificial provision of waterholes. Management could also involve the provision of waterholes may be taken. Management could also involve the provision of salt licks and concentrate diet.

Semi-intensive Production – Farming on fenced range

The semi-intensive system is a form of game production technique where a much greater degree of control is used. The movement of the animals are restricted either by constant supervision or by physical enclosures (which are made of wire fences). In the enclosures, natural vegetation may be allowed to develop. Alternatively, fresh or dried leaves may be provided, and grains and pelleted foodstuffs can also be supplied.

Intensive Production

Intensive rearing of game animals involve the creation of entirely artificial habitats in the form of small cages. A controlled environment is established when a habit is intensively manipulated by man for the purpose of producing the species in question.

A major objective is to keep the largest possible number of animals in the smallest possible space to effect economics in the material used in constructing the cages, as well as to make servicing/reproduction and feeding more convenient. Despite the fact that the cage is entirely unnatural to the animal the whole system must be designed in such a way that the normal requirement of the species involved may be met.

Food habits and growth behaviour

Browse plants are used as food, cover and some have medicinal values to game animals. They can also be used as all year round feed in which case, they can either be incorporated into a rotational grazing system or the leaves can be cut and fed to the animals. Some indigenous legumes which are important browse species are *Indigofera pulchara, Desmodium* sp and trees such as *Parkia clappertonia, Adansonia digitata, Daniella oliveri, Afzelia africana* and *Piliostigma thonningii*.

It is universally acknowledged that different game species partition their food resources to reduce interspecific competition. In effect, each species of games seems to have its own niche, that is, its own place in the environment and tends to avoid direct competion for food with another species in the same ecosystem. Therefore, wild game will make more efficient use of the total plant production in an area of mixed vegetation than domestic livestock will (Darmann, 1992). This is further enhanced by their inherent ability to move greater distances than domestic stock for forage. For these reasons, game species cause less overgrazing than their domestic counterparts.

In comparable conditions of forage, growth rates of game are faster than those of cattle (Table 4).

Table 4: Growth rates (kg day^{-1}) of cattle and Game

Animals	Growth rate (kg day^{-1})
Cattle	0.14
Wildbeest	0.18
Buffalo	0.26
Eland	0.30

Source: Ewer and Hall, 1981.

Spore (1993) in comparing a steer or bullock with 300 rabbits stated that both have the same body weight and require approximately one tonne of hay to grow 109kg of meat. However, the bullock produces this weight in 120 days while the rabbits do so in 30 days.

Reproductive Cycle

Data on the reproductive cycle of each species is clearly essential in domestication/game production. For mammals, information on the oestrous cycle will be used to determine how frequently the female may be receptive to the male. The length of the gestation period indicates in the first place whether mating has

been successful. But it is useful in the initial selection if a choice must be made between a species with a long gestation period which will breed infrequently and another with a short gestation period which may produce more young in a given period.

Litter size and number of litters produced in a year for mammals, clutch size and breeding frequency for birds determine the total number of youngs which may be reared. Lactation periods and time required for weaning of young mammals or incubation and brooding period for youngs birds affect the rate of turnover of the species.

Many of these factors are genetically determined and may not be altered easily. Oestrous cycle, gestation periods and others are usually constant for a given species. Litter or clutch size may be enlarged by improved feeding and survival of young is likely to be high when food is abundant.

Cropping

The number of animals to be cropped annually must be determined by the degree of habitat utilization. The objective is to keep the number and variety of game population as high as possible and consistent with good habitat condition.

Cropping should be conducted so as to minimize disturbance of other animals in the vicinity in the night by carefully selecting for age and sex.

Management Problems

It is immensely essential to fully understand the animals ecological requirements of habitat, its population dynamics, food preferences and other behavioural characteristics including breeding and parental care. Clear knowledge of its ecological requirements will enhance its capture success in the wild and serve as guide to its captive maintenance.

The necessary criteria for easy management are.

(a) Adaptability:- Any animal that is unable to adapt to unusual diet and thrive in strange environment is unlikely to be able to withstand the pressure of life in captivity. Therefore, selection is in

favour of an animal that can feed on readily available low-cost or no-cost feedstuffs and can be acclamatised to local conditions.

(b) Sociability:- This is a desirable characteristics in many cases. Social animals which habitually live in herds both of their own species and with others are likely to learn to accept the presence of man as an additional species.

(c) Docility:- It is also desirable to look for docility rather than aggressiveness of temperament and to avoid species of extreme agility, since agile animals are very difficult to control in captivity and naturally docile species are likely to be easy to handle.

(d) Parasites and diseases:- In well fed stocks of game animals, parasites are presently but rarely become pathogens. An example is the sleeping sickness caused by a protozoan which affects cattle but have no effect on game species. A further source of infection in game production is restriction of movement of the animals. Seasonal migrations or enforced local movement in the wild frequently breaks the life cycle of parasites.

Marketing of game products

Trade in game animals for the various uses provide a means of generating income for diverse categories of people such as: hunters, traders in bushmeat, traders in trophies of game animals for aesthetic values and adornments and traders for traditional medicinal preparations. Hacourt *et al.* (1989) reported that proceeds from sales of captured animals has turned hunting into such a lucrative occupation, enabling younger men to earn more money from it than they would have as manual labourers.

The trophies that are derivable from the proposed ranching schemes are skins, ivory, horns, hoofs and bones. With the exception of ivory which is found only in warthogs, these trophies can be marketed either in treated or untreated forms for ornamental and medicinal uses.

Preservation of games product

Two options are available for the disposal of harvested animals. One is to dispose them on hoof (i.e. live) at estimated prices. The other is in carcass form.

Carcass can be sold fresh or in a preserved form. Forms of preservation include: smoking, refridgeration, sundrying, frying and canning

Problems of games utilization and social acceptance

Game utilization takes several forms. Legal forms include ranching tourism and community-based development. While illegal utilization implies both irregularity and immorality in exploitation of game animals. Illegal hunting is probably the most important and widespread form of wildlife utilization throughout Africa. For example, in the wildlife-rich country of Tanzania it has been estimated that around 60 percent of wildlife utilization is illegal (ITC/IUCH, 1988).

In broad terms, there are two distinct elements to illegal utilization. First, traditional subsistence hunting where products are used mostly for local consumption Second, larger-scale commercial hunting where products are bartered or sold further afield often in the international market-place. Both forms have been practiced traditionally for centuries, as shown, for example, by remains of animals, kills in archaeological sites or the long-standing trade in ivory between Africa and the Far East. The right to practice these forms of utilization went largely unquestioned until this century when laws establishing protected areas and limiting the use of wildlife were passed.

First it is important to return the resources or at least, the revenue earned from the resources to the communities. Anytime there is a divergence between the objectives of local communities and absentee landlords, the result is likely to be wasted and inefficient. Local communities are the best managers of these assets for themselves and for the global community There are clear roles for "outsiders" but ownership (i e. the disenfranchisement of the local community) is not one of them.

The second point is the importance of low intensity utilization strategies. The "natural habitat" that we now observe evolved in the context of low intensity human utilization which includes hunting, gathering, e.t.c. However, other forms of utilization, deforestation and/or conversion to cattle ranching are at the other end of the spectrum of intensity. The positive impact of utilization dwindle as the form it takes moves from low to high intensity.

In essence, this means that overly specialized or capital intensive methods of production generally should not be encouraged in wildlands, because as there is very little positive conservation impact from schemes that substantially alter the environment. Minimal well-slotted interventions can have very substantial productivity impacts. Therefore, where specialization is not necessary, diversity is a possibility.

Social Acceptance

It is apparent that the domestic livestock cannot meet the demand for meat in Nigeria. This implies that there is need for a complementary source of meat.

Market survey in years past established the acceptability of wildlife meat and trophies by most Nigerians. The only exceptions in some areas are the meats of wild pig and monkey families which are not popular because of religious reasons.

Temporary markets for wildlife products are a common place whilst a visit to any of our international airports and standard hotels will indicate the magnitude of trade in wildlife trophies of all descriptions.

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