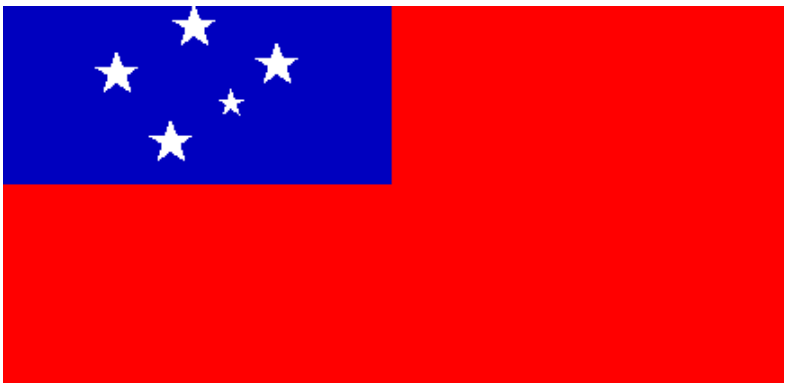
Country Pasture/Forage Resource Profiles

SAMOA



by

Stephen Lee

CONTENTS

1. INTRODUCTION 5

2. CLIMATE AND AGRO-ECOLOGICAL ZONES 6

3. SOILS AND TOPOGRAPHY 6

4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS 7

5. CONSTRAINTS TO DEVELOPMENT OF PASTURE-BASED LIVESTOCK SYSTEMS 9

6. THE PASTURE RESOURCE 9

6.1 Improved pasture grass varieties 10

6.2 Improved legume varieties 11

6.3 Weed control 11

6.4 Recent initiatives in forage improvement 11

Ongoing initiatives 12

7. ORGANIZATIONS AND PERSONNEL INVOLVED IN PASTURE RESEARCH AND DEVELOPMENT 13

8. REFERENCES 13

9. CONTACTS 14

1. INTRODUCTION

Samoa consists of two main islands, Upolu (1 100 km2) and Savaii (1 800 km2) and several small ones. Other inhabited islands are Manono and Apolima. The country forms the western part of the 500 km long Samoan archipelago. It is located in the South Pacific between 171 & 172o W and 14 & 13o S (Figure 1). In 1962, Samoa became the first country in the Pacific to gain independence.

The total land area is about 2 934 km² with an exclusive economic zone of 120 000 km², which is the smallest in the South Pacific.

Samoa is ecologically fragile and vulnerable to environmental degradation of its natural resources. Because of its location, it is exposed to natural disasters – demonstrated by a succession of highly destructive cyclones: Ofa in February 1990 and Val in December 1991, which caused wide-spread damage to the country's economic base and infrastructure.

Figure 1. Map of Samoa

In 1995 the population was around 169 000 people of which 90% were ethnic Samoans. The natural rate of population growth was around 2.4% per annum; however, emigration has reduced the actual population growth to 0.6% per annum (Tevita 1995). In the last census in 2006 the population was 179 186 and the SPC (SPC, 2008) mid-2008 population estimate is 179 645, with a mid-2010 estimate of 179,903 (and a 2008–2010 estimated growth rate of 0.1%). [According to the World Factbook the July 2008 estimated population is higher at 217 083, with a growth rate in 2008 of 1.322%]. Most people live in villages on or near the coast and normally farm the coastal strip and directly inland to the highest point or ridge line. There is a strong trend for people to move from rural areas to the capital, Apia, seeking better work and income opportunities.

With the exception of land owned by government and institutions (mainly churches), land in Samoa is held under customary title. The matai, or holder of the customary title, is entrusted with the management of the land which cannot be sold. The matai in turn, distributes land to his or her extended family for their use. Village councils and the Land and Titles Court are active in allocating unused land and settling disputes over claims to land.

Samoa's economy is based on primary production, much of it at subsistence level. Crops, livestock, fisheries and forestry account for 42% of GDP. The main crops produced are coconut *(Cocos nucifera)*, cocoa *(Theobroma cacao)* and banana *(Musa* spp.). A major staple, as well as export crop, was taro (*Colocasia esculenta*) but production has declined due to taro leaf blight (*Phytophera colocasia*). Recently, due to the destructive effects of cyclones and taro blight, farmers have sought to diversify to taamu (*Alocasia* spp.), ava *(Piper methysticum)*, and cattle production (Lee 1995a).

Samoa has a cattle herd of around 28–29 000 head producing approximately 1 000 tonnes of beef and veal and 1 500 tonnes of milk annually (Table 1). In 2002 a further importation of just under 2 000 head of cattle (1827) took place by ship from Townsville, Australia. Imports of mutton, beef, chicken meat and fresh milk are considerable.

Table 1. Samoa statistics for livestock numbers, beef, veal, pig meat and milk production, cattle imports and beef and veal imports for the period 1997–2007

Item	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cattle nos. (,000)	26	27	27.9*	28	28	28	29	30	30	29	29
Pig nos. (,000)	170	170	167	170	201	201	201	201	201	201	202
Beef & veal prod. (mt)	945	975	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Pig meat prod. (mt)	3 400	3 400	3 400	3 500	3 800	3 800	3 800	3 800	3 800	3 800	4 000
Milk prod. (mt)	1 300	1 350	1 450	1 500	1 500	1 500	1 500	1 500	1 500	1 500	1 500
Cattle imports	220	-	-	-	-	1 827	-	-	-	-	n.r.
Mutton and lamb imports (mt)	3 000	3 900	3 000	4 000	4 700	3 700	3 000	2 299	2 300	2 602	n.r.
Fresh milk imports (mt)	2 000	2 000	1 650	2 100	2 000	1 250	1 054**	1 227	1 125	920	n.r.
Beef & veal imports (mt)	650	600	750	700	800	900	542	560	420	199	n.r.
Chicken meat imports (mt)	1 200	2 800	3 700	4 100	4 800	4 045	6 160	4 816	7 091(+)	4 445	n.r.

Source: FAO Database 2009 . n.r. No records; No data for 2008

** Agriculture census 1999 gave total cattle population of 29,133 head.*

*** In 2000 total milk equivalent import was 6009 mt. and in 2003 it was 4196 mt. In 2005 some 510 Mt of dried and cond. milk was imported*

(+) In addition in 2005 some 1,100 Mt of turkey meat and 195 Mt of pig meat were imported

2. CLIMATE AND AGRO-ECOLOGICAL ZONES

The climate does not vary greatly through the year. The wet season lasts from October to March and the dry season from April to September. The average annual rainfall ranges from 2 000–7 000 mm, although most areas receive <4 000 mm, the highlands of both main islands receive 5 000–7 000 mm, whilst the North-West coastal areas of Upolu and Savaii receive 2 000–3 000 mm. The relative humidity averages 80%, and there is an average of 2 500 hours of sunshine per annum.

The climate is heavily influenced by the mountainous nature of Samoa. Sea winds which are predominantly south-east trades blow gently for much of the year and drop their moisture against the slopes of islands. Temperatures are seasonally uniform with the mean maximum temperature ranging from 27 to 30 ^{o}C and the mean minimum temperature ranging from 20 to 23 ^{o}C (Wright 1963).

Essentially, all areas are in the category of humid tropical climate. The driest area (Western Savaii) having a rainfall of around 2 200 mm pa, with partial drought for 2–3 months in a normal year (Wright 1963).

The highlands experience no dry season. Western areas of both islands typically experience a moderate dry season with 2–3 months of very dry (<60 mm) and 3–4 months of moderately dry weather (<100 mm). Most other areas experience weak dry seasons, of 0–1 very dry months and 1–3 moderately dry months.

Whilst there are a number of soil types, land can be fairly accurately divided into a small number of agro-ecological zones for pastoral production.

- Steep lands
- Young lava flow
- Higher slopes (above 300 m) and central plateaux
- Wet south coast areas (below 300 m)
- Very wet north coast areas of Savaii (below 300 m)
- Moderately wet north coast areas (below 300 m)
- Moderately drought affected east coast areas

There are very few permanently flowing streams and lakes. Watercourses will often flow only during and for a few hours after intense rain. This lack of surface water makes water supply a problem for many farmers.

3. SOILS AND TOPOGRAPHY

Soils are almost entirely volcanic derived, except for a few small areas of coastal (coral) sands. Upolu is a rugged chain of volcanic cones forming a crested ridge rising to 1 100 m. Savaii consists of broad coalescing domes topped by numerous cones, the highest of which rise to 1 800 m (Kear and Wood 1959).

The volcanoes and their resultant soils generally decrease in age from east to west. In Savaii, where the last volcanic eruption was in 1905, there are still areas of virtually barren lava flow.

The land mass of each island rises gently from the sea (with the exception of eastern Uplou which rises very steeply). Therefore, in most areas there is a flat to gently undulating coastal plain (1–2 degrees) which passes into gently rolling slopes (2–5 degrees). These in turn, merge into steeper foothills (5–15 degrees) which continue, sometimes steeply (15–25 degrees), until the upland plateau level is reached at about 600 m in Uplou and eastern Savaii, and at 1 200 m in central Savaii (Wright, 1963). The slopes are often dissected by almost-vertical sided valleys. In general, the upland plateaux are rolling and surmounted by extinct volcanic cones. The land surface is uneven due to the boundaries between different lava flows which have caused steep pitches in slopes, and due to large pits and rifts caused by obstructions to lava flows and collapsed steam tunnels (Wright, 1963). Perhaps the most immediately obvious characteristic of Samoan soils is that they are mostly rocky to extremely rocky.

The parent material of most soils is olivine basalt. There are 55 different soil types. Soils are predominantly stony latosols of varying fertility (Kear and Wood 1959). There are a lesser number and smaller areas of tuff derived soils and even fewer alluvial and colluvial soils derived from basalt (Wright, 1963). Soils are generally low in potassium and/or phosphate. Equitable rainfall, temperature and good soil properties tend to minimise the impact of relatively low fertility on plant production.

Erosion is very rare, except where human disturbance, such as roadmaking, has destroyed the ability of the natural plant cover to control water run-off. Most soils have good structure and subsoils are not compact. Most soils are friable, and when moistened, are non-sticky and non-plastic, free draining with a low water-holding capacity (Wright, 1963).

There are marked and consistent differences between the soils of the lowlands and the uplands and between these soils and those of the highlands. There tends to be an increase in thickness of mineral soil with increasing altitude, due largely to heavier ash deposition in the uplands and the highlands (Wright, 1963).

Temperature has had a very considerable effect on the nature and fertility of soils irrespective of parent material. Weathering proceeds most rapidly at lower altitudes due to higher temperatures (Wright, 1963). However, in general all soils have weathered quickly, and soil fertility of the uplands and highlands tends to decline very quickly after removal of forest cover due to loss of the stabilizing influence of the 15 cm thick mantle of acid forest peat.

Rainfall has a considerable effect on the productive capacity of soils. In areas where annual rainfall exceeds 4 200 mm, even soils from younger parent material are very strongly leached of bases, especially in the sub-soil (Wright, 1963).

4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS

The smallholder livestock subsector has traditionally concentrated on pigs and poultry. Cattle were mainly in the state owned, WSTEC (Western Samoa Trust Estate Corporation) dominated, plantation sector. The historical role for cattle was to act as sweepers for weed control in coconut plantations rather than as a primary source of income. This has affected attitudes to cattle herd management. Most of the large WSTEC plantations have now been split up and leased to private farmers. Today the strength and growth in the cattle industry is in the emerging commercial smallholder sector, including many on former WSTEC lands. Increasingly, entrepreneurial farmers are looking to diversify their production, particularly since taro leaf blight, and to increase income in an increasingly cash dominated economy (Lee, 1995a).

Smallholders usually have between five and fifty cattle on properties where both subsistence and commercial production are carried out. Typically, a farmer will produce livestock, root crops, coconuts and bananas for home consumption, with surplus production sold or used in traditional exchange. Cash is also commonly derived from copra sales, commercial plantations, cattle sales, business, outside employment and remittances from relatives living overseas.

In 1995, the cattle population was split among sectors in the proportions;- Government (3%), WSTEC (12%), NGOs (17%), and private (68%).

There are two main beef markets:

- Retail butcher shops where the prices are dictated by supply and demand. Currently Samoa is a heavy net importer of meat (WST 21 M per annum in 1995).
- The other major beef market is fa'alavelave (traditional exchange).

Samoa has favourable animal health status for cattle, the only major diseases being brucellosis and tuberculosis which appear to have a low incidence.

At present the beef population is based predominantly on a brahman hereford genetic mix, and seems reasonably well adapted to the environment. In 1989, droughtmaster cattle were introduced by the UNCDF–FAO project SAM/85/CO1 which imported 70 bulls by plane from Australia, and additional animals in two cattle shipments in 1993 and 1995. These cattle have adapted very well to Samoan conditions, and have become the breed of choice (Tevita, 1995).

Most pastoral production occurs in mature coconut plantations. This silvo-pastoral system has evolved as farmers, researchers and extensionists have realised that the wide spacing between coconut palms and their great height leaves considerable space and ample light in which to intercrop, and thereby increase income from the same land area. This partly compensates for the volatile nature of returns from copra. The development of pastures suited to the shaded environment has been particularly successful. In Samoa, beef is now the major income earner on land planted with coconuts. On a well managed, smallholder integrated cattle-coconut unit, a farmer can expect a gross margin of around WST 753 per hectare, compared with WST 390 per hectare from producing coconuts alone. Both examples exclude the cost of labour (Lee, 1996).

On large farms belonging to Government, institutions and private farmers, fenced grazing systems are the norm. The style and intensity of management varies considerably, from single herds in which cattle are maintained on a single block of land and only yarded and handled for the purpose of selecting animals for slaughter, to relatively intensive systems where controlled mating and grazing are practised. These farms often employ some level of animal health intervention such as drenching, castration and the use of mineralized salt blocks. Virtually all large farms have received improved bulls, although in some cases their effectiveness is limited by competition from the large numbers of inferior bulls remaining in the herd.

Tethering is a common practice among small-farmers, particularly those with 1–5 cattle. However, they are increasingly opting for fenced grazing systems.

The skill level of farmers in basic animal management and health tasks, such as in calf rearing, castration and wound treatment is limited (FAO, 1998). In the 1970s diploma students at the South Pacific Regional College of Tropical Agriculture (now University of the South Pacific) undertook practical field work in basic animal health and pregnancy testing for which a field manual was produced and later updated for conditions in Queensland, Australia (Stünzner, 1996). This was also used for training plantation managers of WSTEC to upgrade their skills in animal production and management. Recently, some Livestock extension officers have been trained in para-veterinary functions, and this has improved the delivery of animal health services at the farm level. Recent papers presented at the Commonwealth Veterinary Association Conference in Apia, Samoa highlighted the need for appropriate technology to improve beef production in Samoa (Stünzner, 2008).

The Ministry of Agriculture, Forestry, Fisheries and Meteorology (MAFF&M) currently provides direct assistance to farmers to revitalize dairy production in Samoa. The programme is focused on milk production areas and small processing units at the village level. MAFF&M is assisted by FAO and the French Government under their technical co-operation programmes. Objectives are:

1) To facilitate the creation of demonstration units for rural milk processing and dairy production, distribution and marketing;
2) To establish a dairy farmer co-operative whereby local production of milk could be encouraged and the required hygienic standards maintained.

Besides the above, the MAFF&M dairy farm at Avele breeds and distributes dairy calves at subsidized rates to farmers who are committed to developing dairy production.

The Government beef farms at Togitogiga and Lemafa also distribute beef calves to farmers. There are herds of Droughtmaster and Brahman cattle. New herd sires are imported from time to time.

5. CONSTRAINTS TO DEVELOPMENT OF PASTURE-BASED LIVESTOCK SYSTEMS

There are a number of physical and socio-economic constraints that limit pasture-based livestock production:

- Rather than sale for cash in a formalised meat marketing system, much locally produced meat is used as gifts to meet social obligations at events such as weddings and funerals. This appears to be a relatively successful and equitable (cash free) means of distributing dietary protein. A number of farmers have found that community social obligations present good market opportunities.
- Market opportunities for locally produced meat and milk are limited away from Apia, and particularly in Savaii. Consequently, farmers have to divide their time and resources between production, processing, distribution and sales.
- Poor water availability, as a result of the small number of permanent rivers, limits animal performance.
- Low soil fertility in highland and some upland areas causes slow growth rates and poor breeding performance due to nutrient deficiencies.
- Lack of access to development finance, particularly for those farmers (the majority) whose farms are on customary title. Therefore land cannot be used as security for loans.
- Many farmers suffer from under-developed commercial farm management and planning skills.
- The often extremely rocky nature of the soils prohibits the use of mechanised land preparation techniques in many situations.
- Disputes over land are relatively common, and the threat of a dispute can render the prospect of developing land too risky.
- Ministry of Agriculture, Forestry, Fisheries and Meteorology (MAFF & M) lacks the staff and institutional ability to fully support pastoral farmers.

6. THE PASTURE RESOURCE

Nationally, the intensity of land use is quite low, and sales of agricultural products have declined over the last thirty years. Even though the trend is now reversing, there are large areas of unused land which have previously been cleared for plantation agriculture. The largest single area of under-utilised agricultural land is old coconut plantations. Coconut plantations are found generally in a coastal band up to 300 m altitude, on all but very steep slopes, and on soil of moderate to high productive capacity.

There is an estimated 38 000 ha (FAO, 1995) of under-utilized, mainly weed infested (mainly Psidium guajava, Sida spp., Ficus spp., Hibiscus tiliaceous, Macaranga spp.), coconut plantations in Samoa. This is the most abundant, and most economically and environmentally favourable land type for pastoral expansion. Rehabilitation of these areas for cattle production also increases the production levels from coconut enterprises by up to 50%, depending on the type of development and level of management (Reynolds 1995).

Historically coconut plantations have been given high priority in land allocation. Promotion of pastoral development within the ‘coconut belt’ is seen as a desirable strategy because:

There are large areas of previously cleared, under-utilised land available.

- The high levels of natural soil fertility mean that, with limited inputs, high levels of pasture and animal production and profit, with fewer problems such as mineral deficiencies, can be achieved.
- There is easy village access with consequent savings in transportation and labour costs.
- Smallholder incomes from copra production improve because nuts are easier to find in a grazed pasture, and higher yields and lower collection costs may be expected. There is also improved nutrient cycling in the grazed environment and nut production can be expected to rise by approximately 25% (Reynolds 1995).
- There is potential for achieving a greater intensity of land use through rotational cropping of vegetables, bananas and root crops with short term grazed pastures between cropping periods.

Land with appropriate access, slope, fertility and tenure characteristics is in sufficient supply for the on-going expansion of production (Lee 1995b). This is where the majority of pasture development is occurring.

As a result of taro blight (*Phytophthora colocasia*) in 1993, and the subsequent collapse of the taro production and export subsector, many farmers previously growing taro (*Colocasia esculenta*) have elected to develop these former taro plantations into pastoral farms. Such plantations tend to be located on high land (over 300 m), in wet environments (more than 4 000 mm annual rainfall), and on clay soils of moderate to low natural fertility with flat to moderately steep slopes. They are often in remote areas.

6.1 Improved pasture grass varieties

Batiki grass. The principal improved pasture grass variety is batiki grass (*Ischaemum aristatum*). It is not known when this grass was introduced, but it is assumed that it came from Fiji. This moisture loving plant will grow in virtually all areas except western districts of each island where it tends to form a weak sward incapable of competing with weeds. In all other areas it grows vigorously, establishing quickly from seed or, most commonly, from cuttings. Having a very strong creeping habit, it is highly tolerant of heavy grazing and its dense ground cover smothers invasive weeds. It grows well under coconuts.

Batiki is very tolerant of low fertility situations, being able to grow even in very poor highland soils. However, the resultant forage is often severely nutrient deficient. So despite an apparent abundance of feed, cattle will have poor breeding and growth performance, if not given adequate dietary supplements.

Animal performance from batiki grass pasture varies with the level of management. Rotational grazing with a short interval of 21–28 days is required to maintain young leafy growth. Digestible crude protein percentage in the foliage tends to decrease with time, reaching the minimum threshold for maintenance requirement after about 28 days. Reynolds (1995) stated that annual liveweight gains of around 273 kg/ha could be expected from batiki as compared to 127 kg/ha from unimproved grazing.

Aregheore (2001) indicated that there is scant information on the nutritive value of most grass species, inclusive of batiki grass, in Samoa. He suggested that the challenge before ruminant nutritionists and pasture agronomists in using a single grass species as a sole source of forage for animals is to determine whether or not the pasture can supply adequate nutrients for maintenance, growth and production. He also provided mineral composition data on a number of grasses (batiki, guinea and signal).

Results from a trial on the nutritive evaluation of batiki grass with other species such as guinea grass (*Panicum maximum*), and signal grass (*Brachiaria decumbens*) in Samoa indicated that batiki grass has a comparatively low nutritive value. However,the results of another trial demonstrated that a mixture of 60% batiki grass and 40% dadap (*Erythrina variegata)* could satisfy the nutritional requirements of growing goats in terms of voluntary feed intake, growth rate, feed efficiency and apparent nutrient digestibility coefficients (Aregheore, 2001). A further trial (Aregheore, 2002a) showed that *Moringa oleifera* at 20 and 50% levels of total daily forage allowance could be used as a cheap protein supplement in batiki grass based diets for goats.

Signal grass. The second most popular improved pasture variety is brizantha/signal grass (*Brachiaria brizantha*). This requires better management and fertility than batiki. It was commonly planted on large plantations such as WSTEC as an open pasture in more fertile areas with a drier north westerly aspect. Signal grass is planted generally by farmers with larger farms and where seasonal drought may be expected. Some seed of *Brachiaria decumbens* has been imported, but *B. brizantha*, probably introduced by WSTEC, is more widespread and is vegetatively propagated.

Para grass. *Brachiaria mutica* is a common grass in upland plateau areas. Where cattle are not present, or grazing pressure is light to moderate, the species persists well. However, when fenced and overgrazed (almost invariably), the grass will quickly die out leaving low producing broadleafed weeds.

Grasses for drought prone areas. Koronivia grass (*Brachiaria humidicola*) is the most common drought tolerant improved grass grown. Small areas of Bisset creeping blue grass (*Bothriochloa insculpta* cv Bisset) have been planted and show promise as drought tolerant pastures for western areas (Lee, 1996).

Cut and carry feeding is practised by a number of farmers particularly those with pickup trucks. Recently an under-utilized hybrid elephant grass (*Pennisetum purpureum*) has been promoted and *Leucaena* KX2 hybrid was imported for cut and carry feeding principally by small dairy farmers (FAO, 1998).

Other grasses are in the process of being trialled for use by cattle farmers. One of these is splenda setaria (*Setaria sphacelata* cv splenda). To be useful, new introductions need to perform well in the relatively low fertility soils and withstand competition from very aggressive weeds such as navua sedge (*Kyllinga polyphylla*).

6.2 Improved legume varieties

Hetero. *Desmodium heterophyllum* is the most widely occurring pasture legume. It is probably native to Samoa. It is very adaptable and easy to grow from cuttings. This is the first priority for legume introduction in pastures. It is a low growing perennial creeper which can provide an increase in annual liveweight gain from 220 kg/ha for batiki grass alone to 370 kg/ha for batiki-hetero pasture under good management (Trevor, 1998). Rates of nitrogen fixation by hetero of 64 kg N and 110 kg N/ha/year with tall guinea grass and *B. miliiformis* respectively were recorded in Samoa by Reynolds (1982).

Jointvetch. During the 1990s, jointvetch varieties (*Aeschynomene americana* cv. Lee (perennial) and cv. Glenn (annual - weak perennial)) were introduced to Samoa. These legumes have shown good potential in managed grazing systems. They are easy to establish, highly productive (Lee 1996), and grow well in the low fertility soils. Glenn is able to persist due to its heavy seed production.

Centro. *Centrosema pubescens* is naturalised in a number of drier areas of Samoa particularly in north western Uplou and eastern Savaii where it can be found both in unimproved pastures, in improved batiki pastures, and growing on walls where it offers a good source of seed.

Shrub legumes. There is very good potential for increased use of shrub legumes. Successful stands have been grown and managed for specific purposes such as feeding weaner cattle. Failures in the past have often been due to the practice of planting shrub legumes as part of the general pasture improvement strategy and use of incorrect grazing practices. This has caused stand failure through overgrazing and overly short grazing intervals.

Successfully grown shrub legumes are *Calliandra calothyrsus, Leucaena leucocephala* cv Cunningham, *Leucaena* hybrid KX2, and *Gliricidia sepium.*

Aregheore (2002b) and Aregheore and Yahaya (2002) reported on the use of leucaena supplementation with batiki and *panicum maximum* in goat diets. A practice developed by local farmers is to cut *Albizia chinensis* bush fallow to 1 m, plant signal or batiki grass, and manage the regrowth as a shrub legume/grass pasture.

6.3 Weed control

Some exotic weeds such as guava (*Psidium guajava*) require chemical treatment to control them. A technique has been developed using a very low volume of non-residual herbicide (triclopyr as the butoxyethyl ester) applied directly to plant stems. However, the overall need for herbicides in plantations has been reduced as easily applied, appropriate management techniques have been developed which control weed incursion by promoting a dominant pasture (Lee 1995b).

6.4 Recent initiatives in forage improvement

Much of the early development of pasture-cattle-coconut systems in the South Pacific was concentrated on Western Samoa, where a considerable amount of research was carried out from the late sixties to the late seventies largely by a number of FAO projects (see Reynolds, 1995).

More recently the Government of Western Samoa has identified cattle development as an important strategy for import substitution (GWS Development Plan 7). Samoa imports meat to the value of about WST 21 M per year. At the farm level, the choice to develop a cattle enterprise as part of their farm system has been made by many families for various reasons. Some of these are listed below, as ascertained by the author from discussions with farmers and extensionists over a 3 year period.

- **Integration**. Most smallholder farming systems have a rich variety of enterprises carried out on a given area of land. Samoan farmers appreciate the complementary nature of integrating the production of different crops and are quick to realise the benefits of adding cattle to a system particularly for weed control, ease of coconut collection and increased total coconut yield, in addition to beef production.

- **Risk**. Minimising risk is one of the prime reasons for adopting a multi-enterprise farm system. Cyclones are relatively common in Samoa, therefore they have an important influence on the farmers' choice of enterprises for risk management. Cattle farming is seen as a low risk enterprise.
- **Land supply**. Given the current low population and low intensity of land use, land is plentiful and many farmers find that the best management and use of their existing lands is for cattle production.
- **Profitability**. Beef production is certainly profitable. Given the current price of WST 6.6 per kg of carcass, farmers are receiving more than WST 1000 (US$ 400) for a 3-year old steer. Farmers see this as a good return on labour and capital.
- **Social obligations**. The traditional system of ceremonial exchange (fa'alavelave), values carcass and salted beef highly. By farming cattle, a family is well placed to meet it's social obligations and to profit by supplying cattle to others for fa'alavelave. Given responsible herd management, a farmer can achieve a sustainable off-take level. Fa'alavelave also appears to be an equitable non-cash method of distributing beef and adds high quality protein to family diets.
- **Labour**. This tends to be a limiting factor in increasing agricultural production. Beef production is not labour intensive and therefore gives a high return to labour (Lee, 1996).
- **Accumulation of wealth**. In many societies, cattle are seen as a profitable way of building and storing wealth, and in Samoa, this is the case. Cattle grow and increase in value quickly e.g. a 6 month old weaner steer worth WST 500 can be sold 2 years later for more than WST 1000. Even after deducting the costs of production, returns are substantially better than bank rates. Cattle ownership also gives a spin-off in terms of personal status.

Ongoing initiatives

Field trials are currently being carried out to evaluate diets of batiki grass with different ratios of the leaves and browse of multipurpose trees as a means to improve its nutritional content for grazing and confined animals in Samoa. The browses being evaluated are *Leucaena leucocephala, Glyricidia sepium, Calliandra calothyrsus, Erythrina variegata* (dadap), and *Spondias mombin* (vie). These ongoing trials are with goats and steers.

The Togitogiga Government beef cattle farm is dominated by batiki grass. At present, the Livestock Division (MAFF&M) has established a shrub legume plot [a feed garden] planted with *Leucaena leucocephala and Calliandra calothyrsus* at the farm. Animals are allowed to graze in the feed garden at varying intervals in order to supplement the nutrient deficient diet of batiki grass.

Other current initiatives by the Livestock Division include the promotion and demonstration of pasture development on fern (*Nephrolepsis hirsutula)* infested lands employing low cost techniques and inputs accessible to all smallholders (Tevita, 2001).

Aregheore (2000) has stressed the need to better utilize the large quantities of crop residues and agro-industrial by-products generated each year and incorporate them into feed rations.

Tevita (1995) reported that a number of useful co-operation projects had contributed significantly to the development of the cattle industry in Samoa.

- **FAO Veterinary and Pasture Agronomy project – 1970s.** Lack of continuity and resources meant government was unable to sustain this programme.
- **UNDP/FAO Cattle Development Project SAM/86/003. 1992 - 1994**. This project identified and promoted recommended pasture varieties and improvement technologies through MAFF staff training and extension.
- **UNDP/FAO Project SAM/95/001. 1995.** This project carried on the work of the previous project and contributed significantly to increased awareness in farmers through training (to over 450 farmers) and demonstration of pasture technologies.
- **AusAID Livestock Training Project.** This programme offered training for Livestock Division staff and innovative farmers from 1991 to 1998.
- **FAO Project TCP/RAS/4451.** This was a regional training project which held workshops in Vanuatu on pastoral development in 1993.
- **FAO Project TCP/SAM/6611.** This was a smallholder dairy production and processing project which focused on forage based dairy production, the use of local feed resources such as agro-industrial by-products, animal health and micro-scale milk processing.

- **FAO Project GCP/SAM/007/FRA.** This project assisted with training on milk production and processing, organized a successful regional workshop and has produced a CD-ROM entitled "Dairying in the Southwest Pacific".

Future development priorities for the Samoan pastoral sector were also identified by Tevita (1995). These were:

- To continue providing services to enable establishment and management of sufficient quantity and quality pastures to support 40 000 cattle by the year 2010.
- To continue major species development concentrating on proven combinations of grasses and legumes, as well as work on new species adapted to specific areas.
- To work on soil fertility improvement in various parts of the country.
- To continue work on shrub legumes such as leucaena and calliandra.
- To study weed control practices.
- To encourage and promote field days for farmers.
- To establish improved marketing strategies.
- To consider development of abattoir facilities.
- To improve animal health status, and make advance preparation for possible future beef exports.
- To continue capacity building of staff and farmers.
- To strengthen and improve the existing pasture and livestock monitoring programme.

As of April 2001 these priorities remain unchanged (Tevita, 2001)

7. ORGANIZATIONS AND PERSONNEL INVOLVED IN PASTURE RESEARCH AND DEVELOPMENT

Faleuplou Tevita,
Assistant Director,
Livestock Division, MAFF & M,
Avele, Apia, Samoa
ph (685) 21052
fax (685) 26532

Laumata Pelesa,
Senior Livestock Officer (Pastures),
Livestock Division, MAFF & M,
Avele, Apia, Samoa

8. REFERENCES

Aregheore, E.M. (2000). Crop residues and agro-industrial by-products in four Pacific Island countries: availability, utilization and potential value in ruminant nutrition. *Asian-Aus. J. Anim. Sci.* Vol. 13, Suppl. (B), 266-269.

Aregheore, E.M. (2001). The contribution of pasture to sustainable beef cattle production systems in The South Pacific Region. In: Aregheore, E.M., Umar, M. and Adams, E. (eds) 2001 Sustainable Ruminant Livestock Production in the South Pacific Region. Proceedings of the Regional Workshop held on June 25 - July 2, 2001 at Hotel Peninsula, Suva, Fiji Islands, pp. 29-43.

Aregheore, E.M. (2002a). Intake and digestibility of *Moringa oleifera* - batiki grass mixtures by grazing goats. *Small Ruminant Research* 46 (1), pp.23-28.

Aregheore, E.M. (2002b). Voluntary intake and digestibility of fresh, wilted and dry leucaena (*Leucaena leucocephala*) at four levels to the basal diet of guinea grass (*Panicum maximum*). *Asian-Australasia J. of Animal Science and Technology* 15 (8), pp. 1139-1146.

Aregheore, E.M. and Yahaya, M.S. (2002). Effect of fresh leucaena (*Leucaena leucocephala*) leaf supplementation on the growth of young Anglo-Nubian crossbred goats feeding either batiki (*Ischaemum aristatum* var. *indicum* and guinea (*Panicum maximum* grass. *PNG Journal of Agriculture, Forestry and Fisheries*, Vol. 45 No. 1-2.

FAO (1995). Project document, UNDP FAO Livestock and Pasture Development, Project SAM/95/001, Apia, Western Samoa, January 1995.

FAO (1998). Terminal statement (FAO project TCP/SAM/6611) on milk production areas and small milk processing units, FAO Rome 1998.

Kear, D. and Wood, B.L. (1959). The Geology and Hydrology of Western Samoa. New Zealand Department of Scientific and Industrial Research, New Zealand Geological Survey, Bulletin 63. 1959.

Lee, S.D. (1995a). Achievements of UNDP/FAO Western Samoa Livestock and Pasture Development Project, SAM/95/001. In: Lee S.D. and Macfarlane D.C. (eds), *The Status of Forage Based Ruminant Production in the South Pacific*. Proceedings of a workshop held in the islands of Upolu and Savaii, Western Samoa, 8-11 December 1995.

Lee, S.D. (1995b). Cattle under coconuts, a sustainable improved pasture system for South Pacific island countries. In: Lee S.D. and Macfarlane D.C. (eds), *The Status of Forage Based Ruminant Production in the South Pacific*. Proceedings of a workshop held in the islands of Upolu and Savaii, Western Samoa, 8-11 December 1995.

Lee, S.D. (1996). Guidelines for smallholder dairy farmers in Western Samoa. Consultants report to UNDP - FAO project SAM/86/003, Apia, Samoa.

Reynolds, S.G. (1982). Contributions to yield, nitrogen fixation and transfer by local and exotic legumes in tropical grass-legume mixtures in Western Samoa. Trop. Grasslands 16 (2), 76-80.

Reynolds, S.G. (1995). *Pasture -Cattle - Coconut Systems*. FAO RAPA publication 1995/7, Bangkok, Thailand, 668 pp.

SPC (2008). SPC releases latest Pacific population data.

SPC Website http://www.spc.int/corp/

Stünzner, O. G. (1996). Pregnancy Testing: a Cattle Producers' Guide to its Practice and Use in Herd Management. Central Queensland University Publishing Unit ISBN 1 875902 04X, 134 p.

Stünzner, O.G. (2008). Beef Production and Appropriate Technology in Samoa. Paper presented at the 13th Australasia/Oceania Commonwealth Veterinary Association Regional Meeting and Workshop 17-21 November 2008, Apia, Samoa.

Tevita, F. (1995). Country Paper: Western Samoa. In: Lee S.D. and Macfarlane D.C. (eds), *The Status of Forage Based Ruminant Production in the South Pacific*. Proceedings of a workshop held in the islands of Upolu and Savaii, Western Samoa, 8-11 December 1995.

Tevita, F. (2001). Personal communication from Faleupolu Tevita, Assistant Director (Livestock) MAFF&M.

Trevor, P. (1998). Personal communication from the farmer, Peter Trevor of Faaala, Savaii.

Wright, A. (1963). Soils and Land Use of Western Samoa, New Zealand Department of Scientific and Industrial Research, Soil Bureau - Bulletin 22.

Samoa - Website

9. CONTACTS

This profile was written and will be updated from time to time by:

Stephen Lee
Brooklyn Valley, RD3
Motueka, New Zealand
Ph: 643-528-0476
Fax: 643-528-0478
Email: SteveLee@ts.co.nz

[The original version was edited by H.M Shelton; the revised version drafted in May 2001 was edited by S.G. Reynolds and further revised by S.G. Reynolds in May 2006 and January 2009.]