Tackling land degradation and unsustainable land use in Samoa – with emphasis on the Agriculture sector

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Introduction

This paper starts by introducing the global and local situation regarding land degradation and unsustainable land use. It then defines some basic terms; discusses land use and farming systems in Samoa - with a general statement on the relationship between farming systems and land degradation. The paper then describes the types, seriousness, causes and effects of land degradation in Samoa; discusses ways of tackling land degradation and unsustainable land use in Samoa. The paper ends with a summary, and some recommendations and conclusions.

The global situation

Land degradation is a massive, global environmental problem (FAO/UNEP 1995[1]; Howlett 1996a[2]; FAO/UNDP/UNEP 1994[3], Scherr 1999[4]). FAO/UNEP (1995)[1] reported that degraded lands worldwide include 5.8 million km^2 degraded by deforestation - mainly for agricultural production, 6.8 million km^2 degraded by overgrazing, 1.37 million km^2 degraded for fuelwood, 5.5 million km^2 degraded by agricultural mismanagement (as a result of wind and water erosion; salinization and water logging; and soil nutrient loss) and 0.195 million km^2 degraded by industry and urbanization. Thus, overall, about 18.1 million km^2 of land (92% of total degraded land) has been degraded as a result of agriculture, with 32% of it due to deforestation, 30% to mismanagement and 38% to overgrazing.

The local situation

The Pacific islands and Samoa in particular are not immune from land degradation. In fact, the small island ecosystems are especially vulnerable to the problems of land degradation and unsustainable land use because their natural resource base is limited and fragile. Hughes (1998)[5] referred to a number of issues common to inappropriate land use and management in the Pacific islands. However, according to Howlett (1996a)[2], four of the key issues that needed addressing in Samoa are: (a) uncontrolled land clearing for agriculture on sloping land, (b) land tenure and land disputes, (c) attitudes of farmers towards impact of their activities; and (d) lack of information and agrotechnology for sustainable farming.

Some basic terms

For the purpose of this paper, the terms “land degradation”, “land-use policy” and “sustainable land management” are defined as follows:

Land degradation - Land which due to natural processes or human activity is no longer able to sustain properly an economic function and/or the original natural ecological function (ISO, 1996[6] (cited in Choudhury and Jansen, 1999[7]); or, the loss of the productive capacity of the land to sustain life (IFAD 1992[8] (cited in FAO, 1999[9]).

Land-Use Policy - An expression of the government’s perception of the direction to be taken on major issues related to land use and the proposed allocation of the national land resources

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over a fixed period of time. It has a production and a conservation component. (FAO/UNEP, 1999[10]).

Sustainable land management combines technologies, policies and activities that are aimed at integrating socio-economic principles with environmental concerns so as to simultaneously maintain or enhance production, reduce the level of production risk, protect the potential of natural resources and prevent (buffer against) soil and water degradation, be economically viable, and be socially acceptable (Smyth and Dumanski, 1993[11] (cited in Dumanski, 1997[12]).

Land use and farming systems in Samoa

Land use

Soils, land and land-use in Samoa have been discussed in numerous publications, including Ali and Murray, 2001[13]; ANZDEC/DSIR (1990)[14]; Asghar *et al*., 1988[15]; Hughes, 1998[5]; Ward and Ashcroft, 1998[16]; and Wright, 1963[17]. In addition, USP Alafua over the years have published a lot of their research results and reviews on Samoan soils (e.g.: Asghar, 1988[18]). Table 1 gives the main land use by the agricultural households in Samoa; Table 2 the areas under different crops and Table 3 number of the various types of livestock kept by Samoan farmers.

Land Use	Area (ha)	% of Total Land Used
Under Crops	46,444	87.4
Under Livestock	253	14.8
Under Bush/Fallow	2,304	4.3
Under non-agricultural use	1,880	3.5

Table 1. The main land use of the land parcels: Samoa, 1999. Source: Based on GOS (2000:34)[19]

Crop	**Single Crop Equivalent Area (ha)**	**% of Total Area Under Crops**
Coconut	18,737	46.2
Cocoa	4,006	9.9
Banana	4,290	10.6
Other Tree Crops	1,538	3.8
Taro and Taro Palagi	4,249	10.5
Taamu	4,816	11.9
Other field crops	2,9144	7.1

Table 2. Area under different crops: Samoa, 1999. Source: Based on GOS (2000:35)[19]

Households/Type of Livestock	**Numbers Involved / Kept**
No. of households raising livestock	15,915
Cattle	28,000
Horses	2,000
Pigs	167,000
Goats	2,000
Chickens	431,000
Other Livestock	2,000

Table 3. Livestocks Kept and Households Involved: Samoa, 1999. Source: Based on GOS (2000:33)[19]

Farming systems

Farming in Samoa has always been mainly subsistence with small-scale plots which are usually village based. About 40 years ago, Wright (1963)[17] described the four main types of

land use under "agriculture and crops" as: (a) food gardens only, (b) food gardens with cash crops, (c) commercial plantations, and (d) grassland. However, more recently, Tomane (2001)[20] reported that the main farming systems in Samoa may be grouped into four categories, namely: (a) monocropping, (b) intercropping, e.g. cocoa under coconut (c) mixed cropping e.g., banana, taro, yams, taamu and breadfruit under coconut and (d) integrated farming (crop(s) with livestock).

It has been reported that, in general, monocropping (rather than the more traditional systems such as mixed cropping and integrated farming) is more likely to result in land degradation via soil erosion due to rainwater (Tuivavalagi *et al*., 2001[21]). However, a key factor in the degree of erosion due to rainwater is the amount and nature of ground cover provided under each farming/ cropping system. The greatest damage will be caused on sloping land where land is bare/uncovered during times when the soil is being disturbed (e.g., at time of land preparation, planting or harvesting) particularly in the rainy season.

Types, seriousness, causes and effects of land degradation in Samoa t**ypes and seriousness**

Various types of soil and land degradation have been explained by previous authors including FAO/UNDP/UNEP (1994)[3] and Scherr (1999)[4]. As only to be expected, authors differ in their approach to describing and classifying land degradation. Douglas (1994)[22] (in FAO, 1999[9]) recognizes that land degradation has five main components: (a) soil degradation, (b) vegetation degradation, (c) water degradation, (d) climate deterioration, and (e) losses to urban/ industrial development. Each of these major components could be subdivided into more specific types of degradation. Table 4 lists various types of land degradation and their seriousness in Samoa.

Type of Land Degradation	**Seriousness (0-100)***
Eutrophication; Pan formation; Salinization; Subsidence; Terrain deformation; Waterlogging; Wind erosion	<5
Crusting/Sealing; Pollution	5
Urban and industrial encroachment onto agricultural lands; Agricultural lands covered by volcanic lava flows	5-10
Aridification; Compaction	10
Biological degradation; Rangeland degradation	15
Acidification	20
Water erosion	60
Fertility decline/Nutrient	70
Depletion	
Deforestation	80

Table 4.Types and Seriousness of Land Degradation in Samoa

*Based on authors' rough estimates using a scale of 0 (not a problem in Samoa) to 100 (an extremely serious problem in Samoa)

The ranking in Table 4 seems to agree with Peteru (1993:45)[23] who stated that "Deforestation is perhaps the greatest single threat to Samoa's environment. The ranking also seems to agree with the results of a PRAP workshop held in Suva about five years ago (cited in Hughes, 1998)[5]. In this workshop, participants considered six land/ soil problems in the Pacific and, for the Samoan situation, ranked them, in descending order of importance, as follows:

Land pressure>soil fertility declin >soil erosion>poor soil drainage = water logging>drought
where *"land pressure"* may be equated with *"deforestation"* as *"land pressure"* is a major cause of *"deforestation"*

Causes of land degradation
While discussing the causes of land degradation in the Pacific, including Samoa, Hughes (1998)[5] recognized and distinguished between (a) natural degradation hazards, (b) direct causes of land degradation, and (c) underlying causes of degradation - as given below with some modification:
(a) Natural degradation hazards
- Cyclones
- Drought
- Volcanic activities

(b) Direct causes of land degradation
- Overcutting of vegetation
- Shifting cultivation without adequate fallow periods
- Overgrazing
- Non-adoption of soil-conservation management practices
- Extension of cultivation onto lands of lower potential and/or high natural hazards
- Improper crop rotation
- Unbalanced fertilizer use
- Overpumping of groundwater

(c) Underlying causes of land degradation
- Population increase
- Attitudes
- Economic pressure
- Land tenure
- Land shortage
- Poverty

Effects of land degradation
FAO/UNDP/UNEP (1994)[3] has grouped the effects of land degradation as "effects upon production" and "consequences for the people" as shown below:
Effects of Land Degradation Upon Production
- Land is abandoned (where degradation is severe)
- Crop yields are reduced
- Inputs and costs of production are increased (where farmers attempt to combat reduced yields by increased inputs)
- Responses to inputs are decreased
- Flexibility of land management is decreased
- Risk is increased
- Labour, and technical and financial resources are diverted to reclamation

Consequences of Land Degradation for the People
- Landlessness is increased;
- Food supplies are reduced or less reliable;
- Labour requirements are increased; and
- Incomes are decreased.

However, there are other possible consequences of land degradation, e.g. reduced vegetation cover to the soil, reduced return of organic matter, and less biological activity in the soil; increased pollution from increased use of agrochemicals; and migration of young people elsewhere to search for employment opportunities. While referring to deforestation, Peteru (1993:45)[23] reported that: *"Its effects include: top-soil loss; watershed destruction with subsequent water shortages; drinking water contamination; biodiversity loss; coastal flood damage during the rainy season; marine pollution; and cultural impoverishment"*.

Tackling land degradation and unsustainable land use

There are two major objectives in tackling land degradation and unsustainable land use. The first is to regenerate degraded land; and, the second objective is to promote the use of sustainable land management practices.

Land-use policy and land use section

Farmers and other land users and stakeholders sometimes place emphasis on production and output and neglect issues relating to sustainability of land use. For this reason, Samoa's development of its Land-Use Policy and its intention to establish a Land Use section are steps in the right direction.

National task force

In addition to the above steps, it is suggested that Samoa consider the establishment of a task force at the national level. Such a task force may include staff of appropriate government departments (e.g., DLSE, Agriculture, Forestry, PWD, etc.), NGO representatives and traditional representatives. Initially this task force may act as a watchdog - monitoring the sustainability of land use practices and keeping the government and public informed. Later on, particularly when adequate funding is available, the task force may take a more active role in the implementation of the land-use policy and in identifying and tackling land degradation and unsustainable land use in Samoa.

Causes versus symptoms of problems

In many cases, land degradation and unsustainable land use are simply symptoms of the real or underlying problems which may be population increase, poverty, attitude, etc. (see Section III). In order to successfully tackle land degradation and unsustainable land use, their underlying causes should be understood and addressed. Friedman (2000)[24] and others have reported how environmental projects around the world have failed because they did not consider the underlying causes of the problems.

Publications

DLSE and SPREP have a lot of resources regarding the Samoan environment including its land resources (e.g., DLSE, 1994[25]; Peteru, 1993[23]). In addition, others who have discussed ways of tackling the problems of unsustainable land use and land degradation include Bouma (1997)[26], FAO (1993a[27]; 1993b[28]; 1995[29]; 1999[9]; 2000[30]), Howlett (1996a[2]; 1996b[31]), IBSRAM (1996)[32], Lemalu and Baisyet (1996)[33], NRC (1993)[34], Pretty (1995)[35] and others. It is essential that those interested in tackling land degradation and unsustainable land use in Samoa should first go through these published literature. Some are produced specifically for the Samoan situation, e.g. Peteru (1993)[23] and GOS (1994)[36]. However, it is important that frameworks developed outside Samoa (e.g. the FAO/UNEP 1995[1], 1997[37], 1999[10] framework) have to be adjusted or modified to suit the local situation. For this reason, it is important to involve local persons in management or advisory positions in projects involved in tackling land degradation and unsustainable land use.

Bodies and organisations

In Samoa, a number of organizations and government departments have been or could be involved in tackling the problems of land degradation and unsustainable land use. Some could play a more significant role while others have yet to be involved. Table 5 shows some of the bodies or organizations that have been and could be further involved in tackling the problems of land degradation and unsustainable land use in Samoa. It is important that these bodies and organizations, together with representatives of farmers and other stakeholders be identified and involved in the efforts to tackle land degradation and unsustainable land use.

Body/Organization*	**Selected (Potential) Activities**
DLSE	Field Projects: Publications; Environmental Forums
Agriculture Department	Research; extension; in-service training for staff; publications
Forestry Division	Extension work in agroforestry and watershed management
Education Department	Primary & secondary schools; Teachers College; Agriculture Projects
NUS, USP Alafua, FAO	Teaching; research; publication; training workshops Technical Assistance
Embassies; UNDP; UN Theme Group(s) IBSRAM	Funding Research; workshops for farmers, government and NGO staff; extension; publications
METI; OLSSI; WIB	Research, extension; training/workshops for farmers
SPC; SPREP	Publication; field projects
Forum Secretariat	Coordination

Table 5: Some of the Bodies (That Could Be) Involved in Tackling Land Degradation and Unsustainable Land Use in Samoa and their (Possible) Contribution

*Other bodies include Faasao Savaii, Health Department, SLC, STEC, private sector and traditional representatives and other bodies identified in Peteru (1993)[23]

Geographical information system and remote sensing (GIS&RS)

GIS and RS are extremely powerful tools that could play a significant role in tackling land degradation and unsustainable land use. There will be an increased need for people trained in these areas. In addition there is a need to coordinate the activities of those currently having access to GIS technology. Further details regarding the current situation and future needs regarding GIS/RS have been compiled by Crawley (2000)[38].

Technical solutions to major problems

It is most likely that technical solutions to the problems of land degradation and unsustainable land use are already known, e.g., agroforestry, mulching, cover crop, crop rotation with legumes, etc. For this reason, it is important that the huge body of literature in this field be thoroughly reviewed so that workers in Samoa do not end up spending scarce resources trying to "re-invent the wheel". The challenge is to identify and fine-tune technical solutions that are appropriate for the Samoan situation in terms of the country's biophysical as well as socioeconomic and cultural makeup. For this reason it is important to engage social scientists in projects and activities that try to tackle the problems of land degradation and unsustainable land use, as has been pointed out by Lawrence *et al.* (2001)[39] and others.

Section III of this paper shows that the three main types of land degradation problems in Samoa are (a) deforestation, (b) fertility decline/ nutrient depletion; and (c) soil erosion due to rainwater. With our limited resources, it may be wise to focus our activities on tackling these three major problems. Possible activities that we may consider are given below.

Deforestation: According to Peteru (1993)[23], there are two causes of deforestation in Samoa apart from natural degradation hazards or "acts of God". These two causes of deforestation are agricultural clearing or agrodeforestation and, only on Savaii, commercial logging. To tackle the problem of agrodeforestation, the following activities could be considered:

- Practice agroforestry;
- Practice corridor clearing (where corridors or strips of forests rather than the whole forests are cleared);
- Increase the intensity and/or effectiveness of current farming/cropping practices to reduce the need for more clearing;
- Increase public awareness of this problem; and
- Put in laws and regulations at the national, sub-national and local levels.

Fertility Decline/ Nutrient Depletion: To tackle this problem the following activities could be considered:

- Use of organic (composts, prunnings, farmyard manure, etc.) and inorganic inputs;
- Intensive fallowing (which includes application of lime, planting of legumes, etc. on fallow lands - to quicken rejuvenation of degraded lands);
- Practice agroforestry, particularly with the use of nitrogen-fixing trees such as *Erythrina* species (dadap or *gatae*), etc;
- Crop rotation using nitrogen-fixing plants (such as peanuts etc) in the rotation; and
- Liming where appropriate (i.e., especially where pH<5.5).

Soil Erosion: To tackle this problem, the following activities could be considered:

- Practice agroforestry; consider planting of trees and shrubs along contours;
- Practice bench terracing where appropriate;
- Plant grassy strips;
- Contour ploughing and/or planting;
- Conservation (/minimum/zero) tillage; and
- Consider introducing vetiver grass if not found locally.

Vetiver has been used very effectively to control erosion in many countries in the world - including some in the Pacific. According to NRC (1993)[34], the vetiver grass grows in Samoa but this has to be confirmed as the authors have not seen any vetiver grass growing in the country. If not growing locally, it can be safely introduced because the plant does not produce viable seeds and its growth habit is always localized.

Free trade and globalization

Numerous authors (e.g. Buttel 2001[40]) have warned that the globalization processes need to be taken seriously - particularly with regard to their possible negative effect on the environment. And, as pointed out by Friedman (2000)[24], individual countries should have their "internal wiring" (e.g. Land-Use Policy, etc.) properly in place before plugging in directly into this new powerful system of globalization, otherwise the result will be a meltdown leading to poverty rather than growth and development leading to wealth and prosperity.

Conclusions

From the above presentation, the following summaries, conclusions and recommendations can be made:

- Land degradation and unsustainable land use is a serious problem worldwide, in the Pacific and also in Samoa;
- The most serious types of land degradation in Samoa include (a) deforestation, (b) fertility decline/ nutrient depletion, and (c) soil erosion by rainwater.
- In order to successfully tackle land degradation and unsustainable land use in Samoa, it is important to understand the underlying causes and to go through the large volume of literature that has been produced in this area.
- There are a number of organizations and bodies (national, regional and international) in Samoa that are involved in tackling the problems of land degradation and unsustainable land use in Samoa and there is a need to coordinate the activities of these different bodies.
- FAO, in collaboration with UNEP, has come up with a framework for land resources development and management (FAO/UNEP 1995[1]; 1997[37]; 1999[10]). This and other frameworks have been put together by experts at a great expense and could be considered, with appropriate modifications, for the Samoan situation.
- It is recommended that Samoa consider the establishment of a national task force - initially to act as a watchdog monitoring land degradation and land-use sustainability in the agriculture sector, but the task force may later play an important role in the implementation of the country's land-use policy, particularly when adequate funding is available.

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