Sudan University of Science and Technology

Scientific Research Council

Research Proposal Form

FOR OFFICIAL USE ONLY		
Date of Submission	**Research Area**	**Serial Number**

Section One: General Information

Title of the Research Project:

Climate Change and Vegetation Pattern and status Facilitations in Semi-Arid of Central Sudan

Title in Arabic:

التغيرات المناخية وأثرها علىنمط تكوين الغطاء النباتي في وسط السودان ذات المناخ شبه الجاف

College: Forestry and Rang science Sob

Department: Botany and Environmental Science

Project Language	Project Duration	Project Budget
……English……..	Three years	26750 SG

Principal Researcher:
Name: Nawal Khidir Naser Al-Amin
College: forestry and range Science
Telephone: 0914653103 Fax: …….
E-mail: nawalkn@yahoo.com..

Signature: …….……Date: 4 /07/2007....

Participant Researchers:

s	Name	Institution
(1)	Ali Khalid Ali Elsafori	SUST
(2)	Mohammed Aljamry….	SUST
(3)	…… ……	……
(4)	…… ……	……
(5)	…… ……	……

Head of the Research Unit:

Name: ……..... Signature: …… Date: …….

Dean of the College:

Name: …….……..……. Signature: …….…… Date: ……....

Section Two: Project Description

1. Summary:

This project is aiming to study the status and pattern of vegetation between two Niles, White and Blue Nile (Gezira area) and the impact of the climate change. since the vegetation pattern is related to the rainfall redistribution and the capability of the plant community to improve their microenvironment, soil properties, plant species and their tolerance to drought and climate parameter (rain, temperature, relative humidity) will be analyzed. Remote sensing and GIS will used to develop a map as a baseline study for the soil and plant samples and pattern

2. Justification:

The sparse vegetation (at the study area) is very effective in protection and controlling soil degradation (AL-amin 2005).This sparse vegetation is degraded and the area is under desertification process, particularly drifting sand, which is a real hazard to Gezira Scheme, where this natural sparse vegetation is the front defense line**.** Its protection, regeneration and rehabilitation remain crucial. Therefore research is needed to assess the vegetation pattern and its relation to run on/run off and its ecological dynamic and then to propose a strategy that addresses problems more effectively.

3.Goals: To acquire knowledge on current vegetation status, pattern and then investigate whether the positive feedback and spatial redistribution of runoff of water are sufficient to explain the vegetation pattern formation in this locality. Then to assess the magnitude of the potential hazard by monitoring the landscape biological and ecological multi temporal Changes, to suggest suitable mitigation, reclamation and prevention measures that could protect the sparse natural vegetation.

4. Specific Objectives: This study aims to:

(I) Map the vegetation pattern and their relation to the rainfall distribution (runoff/run on) using remote sensing and GIS,

(II) Assess the vegetation cover status and its natural regeneration,

(III) Monitor the impact of the recurrent of drought on vegetation status.

5. Literature Review:

Land degradation as wind or water erosion is a serious environmental problem worldwide and a major threat to the sustainability of agriculture and economic development. The effective measures for wind erosion control include vegetative, engineering and chemical methods, while measures for water erosion include transform topography, tillage and crop rotation management, mulching and rainwater harvesting system. Success in soil and water conservation needs to be integrated within a comprehensive agricultural management system. (Peter et. al., 2001). In semi-arid degradation continues unabated and many of the causes and the consequences have been extensively studied. (Peter et. al., 2001).He used ECOTONE to predict the effects of climatic fluctuations and disturbance frequency on local and regional patterns in species dominance and composition, he attributed *the* failure of many attempts to stop or reverse dry land degradation to failure to (1) recognize when ecosystems have crossed ecological, edaphic or geomorphic thresholds, and (2) identify and address the properties and/or processes at relevant scales that confer resistance.

The most important causes of land degradation in Sudan, aggravated by drought are: (i) man made land misuse due to overgrazing, (ii) cultivation of unsuitable and marginal lands, (iii) wood cutting and deforestation, (iv) clearance for cultivation expansion, and (v) declining (rainfed) food production (yields). (Luukkanen et al., 1999). The effectiveness of a biological barrier to reduce erosion is determined by wind speed and duration, erodibility of the surface, and biomass distribution, that is shape, height and porosity/permeability of the barrier (Chepil and Woodruff, 1963; Lyles, 1988). (Bagnold, 1941; Chepil and Woodruff, 1963; Wilson and Cook, 1980). According to Evans (1992) and Mohammed et al. (1995b), important amongst relief measures in general are tree strips and/or shelterbelts. It is necessary to protect large tracks of completely or nearly

completely desertified land in Central Sudan by natural scattered vegetation (Al-Amin 2005 and 2006,Kainkwa and Stigter, 1994; Stigter et al., 1997). The effectiveness of sparse vegetation to reduce wind force and protect the surface, a situation more common in dry regions of central Sudan, was thoroughly considered by Nickling and Wolfe (1993).

6. Key Words:

Climate change, vegetation, pattern, formation, GIS, semi arid, Sudan

7. Methodology:

a- Study Area**:**

The site is located between the White and Blue Nile, between latitudes 14° and 15° N and longitude 32° and 33° E, in Central Sudan. It consisted of a vast bare soil (about 5500 km^2) without obstacles, with some scattered sand dunes and sand sheet with hummocks around the area. The area is subject to blowing sand from south and southwest during summer time and from north and northeast during winter. In the rainy season (from July to September) the site appeared subject to overland flow (run-on and runoff) of high velocity and short duration.

b- Vegetation Pattern

To depict both spatial and temporal variation in vegetation, vegetation intensities on different dates will be compared, using multi-temporal color NDVI (normalized difference vegetation index) composite. Acquiring and analyzing multiple temporal spectral modist images of band (I) and band (II) (year 2000-2007) for the area covering dry and wet seasons and band math of ENVI (Environment for visualization image Programme) will be used to calculate NDVI for each image. This image data will be used for complete classification of the land cover (based on NDVI time profile). The multi-

temporal NDVI image sets will be classified by un-supervised classification and cross-checked by ground survey, and then produce land use map. For climatic properties (aridity and drought) monthly total rainfall, temperature, relative humidity and evapotranspiration for years (2000-2007) will be analyzed to find the period of drought spell.

c-Vegetation Status

An accurate vegetation status will be carried and from the map developed in section b, random samples for soil and vegetation will be located and taken. Number of samples should constitute 20 % from each map units (bare soil and vegetated area). To study the vegetation cover status ecological parameters such as density, abundance, similarity and natural regeneration have to be considered, therefore, the following measurement will be carried:

1- Natural Regeneration (N.R)

To determine N.R. Systematic sampling of (10x10m) has to be carried by counting new seedlings for all species/area. Then N.R will be calculated as follows:

$$N.R.S. = \frac{No.ofseedling\ s\ /\ area}{No.ofsamplesX\ samplearea}$$

2-Association

Systematic sample of (50X50 m) will be taken for measuring association using chi-square (X^2) and contingency table as follows:

		Specie x		
		+	-	
Species Y	+	a	c	a+c
	-	b	d	b+d
		a+b	c+d	N

$$X^2 = \frac{\left(|ad - bc| - 0.5N\right)^2 \ N}{(a+b)(c+d)(a+c)(b+d)}$$

Where : a = both species x and y are reported;

b= species X is present but species y is absent;

c= species y is present but species x is absent;

d= both species X and Y are absent; N = total number of quadrat.

$$J.O. = \frac{(a+b)(a+c)}{N}$$

Where: J.O. = joint occurrence of species.

3- Diversity indices:

The index used for measuring diversity is the index Simpson's; the following equation should be used:

$$SiD = \frac{N(N-1)}{\sum n(n-1)}$$

Where:

SiD= Simpson's index of diversity;

N= total number of individual;

n= number of individual of each species. Then from the measurements the vegetation density, abundance and frequency will be calculated.

c- Soil properties

To determined the soil properties (following the standard methods)five soil samples per map units at two depths: 0-30 cm and 30-60 cm will be taken and then the following soil properties have to be determine: 1- bulk density;2- erodibility; 3- moisture; 4- salinity and Sodicity; 5-tecture; 6-aggregate; 7-infiltration rate and 8- soil seed bank.

8. References:

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7. Debra P. C. Peters1 and Jeffrey E. Herrick (2001). Modeling Vegetation Change and Land Degradation in Semiarid and Arid Ecosystems: An Integrated Hierarchical Approach. Advances in Environmental Monitoring and Modeling Vol. 2 No. 1 (2001) .

Section three: researchers and their responsibilities.

Researchers	QUALIFICATIONS	Academic status	Main Specialty	Responsibilities
1.Ali Khalid	PhD	A prof	Botany	Vegetation cove analysis
2. Mohammed Aljamry	PhD	A Prof	Forest management	Remote sensing and GIS

Section Four: Budget Phases

Duration of the project: Three years Total budget:26750 SG.