ANNEX 1

Poverty Indices

The selection of an appropriate level of welfare is reflected in the choice of a cut-off or poverty line. Apart from the selection of a poverty line, the measurement of poverty generally focuses on computing three indices. These reflect:

(a) The prevalence or incidence of poverty as measured by the fraction in the total population living below the poverty line i.e. *the head-count* ;

(b) The intensity of poverty reflected in the extent to which the income of the poor lies below the poverty line, as measured by the differences between the two, i.e., *the poverty gap;*

(c) The degree of inequality among the poor in such a way that income transfers from the worse among the poor to the less poor should raise measured poverty and vice versa, i.e., *the severity of poverty index.*

Foster, Greer and Thorbecke (1984) have suggested a useful general index that meets these requirements. Their class of poverty indices takes the following form:

$$P = \frac{1}{N}\sum_{i=1}^{q}[(Z_p - Y_i)/Z_p]^{\alpha}$$

where Z_p denotes the poverty line, Y_i the expenditure or income of the I-the poor household (or individual), N the total number of households and q the number of households whose expenditures or incomes are below the poverty line and expenditure or income of the poor as a fraction of the poverty line $[Z_p - Y_i]/Z_p$, raising it to a power α and then summing over all poor units. Not only does the index take into account the prevalence and intensity of poverty; it may also be used to reflect the degree of inequality among the poor by varying the value of the α parameter.

Thus, if α=0, index $P_{\alpha \text{ becomes}}$ P_0 = q/N, which has been referred to as *the head-count index.* It reflects the proportion of total population lying below the poverty line, i.e. the proportion of poor in the total population. This measure is indifferent to the extent of poverty of the poor. It is only sensitive to their number and reflects the prevalence of poverty.

Alternatively, with α=1, the poverty index P_{α} becomes:

$$P_1 = \frac{1}{N}\sum_{i=1}^{q}[Z_p - Y_i]/Z_p = IP_0$$

where I is the "income gap ratio", i.e. the mean income gap of the poor (Z_p - Y) where $Y = \Sigma Y_i / q$ is the mean expenditure (income) of the poor expressed as a fraction of the poverty line. Thus, P_1 is the income gap ratio multiplied by the head-count index. This index gives a good measure of the extent or intensity of poverty as it reflects how far the poor are below from the poverty line. It may also be used to show the amount of income, under perfect targeting, that needs to be transferred to the poor to close the poverty gap in order to eradicate poverty. However, P_1 is insensitive to income distribution among the poor. Income transfers between the poor will leave P_1 unchanged. For this to be reflected in the index, greater weight has to be given to the poorest units. This can be achieved by setting α=2.

If α=2, the poverty index becomes

$$P_2 = \frac{1}{N}\sum_{i=1}^{q}[(Z_p - Y_i)/Z_p]^2$$

P_2 is the mean squared proportionate poverty gap. This index is not easy to interpret as compared to P_0 and P_1. However, it has the advantage of reflecting the degree of inequality among the poor, in the sense that the greater the inequality of distribution among the poor and thus the severity of poverty, the higher is P_2.

This class of poverty indices is additive. It permits the summing up of poverty indices for various subgroups in the population.

ANNEX 2

Abbreviations, descriptions and units of measurement for the degradation indices and 31 variables (grouped into six broad categories) used to develop the predictive models of land degradation in South Africa

Abbreviation	Variable name and description	Units
Degradation indices		
SDI	Soil degradation index	index value
VDI	Veld degradation index	index value
SDI + VDI	Sum of soil and veld degradation indices To give a combined index	index value
Biophysical variables		
AREA	Area of the magisterial district	km²
ALT	Altitude: Mean height above sea level	m
SLOPE	Mean percentage change in altitude over A 1'X 1' "o	%
RUNOFF	Runoff intensity calculated as the mean Annual runoff per secondary catchment	million m³
ERODIBILITY	An index of erodibility determined by slope, Soil type, rainfall intensity and land use	1(high)-20 (low)
FERTILITY	Soil fertility as a function of the clay content And base status of the soil	0(low)-9 (high)
Climatic variables		
MAR	Mean annual rainfall	mm
SAI	Summer aridity index defined as the sum of the mean precipitation for the four hottest months of the year	mm
MAP: PET	The ratio of mean annual precipitation Potential evapotranspiration	-
TMEAN	Mean annual temperature	mm
GROWDAYS	Duration of the moisture growing season	# of days
Land use		
MERCIAL	% area of the magisterial district managed Under a favoured land tenure system	%
% CROPS	% area of the magisterial district used for crops	%

Continued : ANNEX 2

% VELD	% area of the magisterial district used for grazing lands	%
% FOR	% area of the magisterial district used for commercial forests	%
% CON	% area of the magisterial district used for conservation areas and state land	%
% SET	% area of the magisterial district used for human settlement	%
% OTH	% area of the magisterial district used for other land use practices (e.g. mining, lakes)	%
LSU/HA	1995/96 stocking density (no. of cattle, sheep Goats and equines calculated in Large Stock Units)	LSU/ha
Demography		
POPDEN	Population density: 1991 census	# of people/km^2
%MALE	% composition of males in the population	%
% 15-64	% composition of people between 15-64 years of age in the population	%
%RURAL	% composition of people located in rural areas	%
Labour and employment		
%UNEMPL	% of the labour force which is unemployed	%
AGREMPL	% of the formally employed labour force which is Employed in agriculture, forestry and fishing sector	%
LABAGROW	The employment growth performance index of the agriculture, forestry and fishing sector % of the provincial average	index value
#DEPEND	The total dependency ration. i.e. the number of people dependent on a household head	# of people
Economic production		
GGP/CAP	Gross geographic product per capita	Rands/person
AGRTOGGP	% contribution of agriculture, forestry and Fishing sector to the GGP	%
AGROWTH	% average annual growth in agriculture, forestry Fishing sector : 1981-1991	%
GGPGROW	Total % average annual growth in GGP: 1981-1991	%

ANNEX 3

Proposed Definitions of Land Types

Definition	Biophysical Constraints	Socio-Economic Constraints
Favoured land: Land having no or moderate limitations to sustained application under a given use. Moderate limitations will reduce benefits but an overall advantage will be gained from the use of inputs. Wide options for diversification. With roper management, risk of irreversible damage is low.	No or moderate constraints related to soil, climatic and terrain conditions. Soil fertility, if adequately maintained, is favourable. Relatively reliable rainfall and/or irrigation water.	The level of yields depends not only on favourable biophysical conditions, but also on accessibility to inputs, market and credit facilities, and beneficial output/input ratios.
Marginal land: Land having limitations, which in aggregate are severe for sustained application of a given use. Increased inputs to maintain productivity of benefits will be only marginally justified. Limited options for diversification without the use of inputs. With inappropriate management, risks or irreversible degradation.	Soil constraints (low fertility, poor drainage, shallowness, salinity), steepness of terrain, unfavourable climatic conditions[14].	Absence of markets, difficult accessibility, restrictive land tenure, smallholdings, poor infrastructure, and unfavourable output/input ratios.
Fragile land: Land that is sensitive to land degradation, as a result of inappropriate human intervention. Sustained production requires specific management practices. Land use is limited to a narrow choice of options.	Soils of low fertility, erodible, steep terrain, and high groundwater levels, flood-prone.	Population pressure, food deficits, competition for land from other sectors, unavailability or high cost of inputs.
Degraded land: Land that has lost part or all of its productive capacity as result of inappropriate human intervention[15]. Various forms and degrees of degradation, both reversible and irreversible, may occur. Rehabilitation of reversible forms of degradation requires investment.	Erosion, salinisation, fertility depletion, lack of adequate drainage on soils and terrain prone to deterioration.	Population pressure, land shortage, inadequate support to agriculture, lack of institutional framework, high cost of rehabilitation, lack of investment.

[14] The soil, The soil, terrain and climatic constraints applicable to marginal lands are described in Annex 1. The constraints may apply separately or cumulatively.

[15] A distinction needs to be made between reversible and irreversible forms of degradation. Some soils are vulnerable to nutrient depletion, but are sufficiently resilient for soil fertility to be restored through good management.

ANNEX 4

Imperatives for Poverty-Oriented R &D and Dominant Characteristics of Current Research for MAs

1. MA Context and R &D Imperatives	2. Dominant Features of R & D by NARS/others and Gaps between (1) and (2)
A. Imperatives of Soil and Slope Related Constraints (e.g., erodibility, fragility, low fertility, low depth, etc.): **Technology** for **Resource** building, stabilizing, upgrading, protection, conservation; **Crop types:** shallow rooted, nitrogen fixing; annual-perennial compatibility, favouring intensive-extensive land uses; strengthening integrated framing systems including the use of CPRs.	Considerable R & D results on soil-moisture conservation measures; agroforestry, crops (coarse grains, legumes to suit MAL). But work less oriented to local situations; focus on intensification ignoring extension and system context; not enough learning from indigenous systems; impacts in scattered pockets; domination of product-centered over resource-centered R & D.
B. Imperatives of Water-related Constraints (e.g., short and fluctuating growing season, frequent drought etc.): **Moisture management:** small-scale water harvesting, moisture conservation measures; Crops resistant to moisture uncertainty and scarcity; flexible input regimes; potential for multiple usage and salvage value as well as diversification.	Considerable results on drought resistant varieties; water conservation. But not oriented to their role in farmers' overall strategies against moisture uncertainty, scarcity and diversification; water-harvesting/ moisture conservation technologies developed but their adoption still limited both due to scale factor and need for group action, as well as inability to link them with total farming system.
C. Imperative of diversity based opportunities and constraints: Site-specific Technologies **for crops and resource management to suit soil/slope/moisture and infrastructural diversity – involving crops/livestock/vegetation; focus on minor crops, niche opportunities, common property resources, etc., in a "systems framework".**	Work focused on limited and their attributes (e.g., grain yield and not total biomass), ignoring the need for diversification, and harnessing location-specific niche with high pay-off; limited learning from traditional systems for adapting to limitations and opportunities of MAs.
D. Imperatives of biophysical conditions related to social processes: Strong agro-ecosystem social system linkages to shape choice and design of production options and practices as a part of diversified farming system; Institutional arrangements for resource-use regulation.	Despite good work on farming systems, research has been persistently top-down disregarding indigenous systems and participatory approaches, resulting, resulting partly from subdiary role of social science; inadequate attention to institutional aspects.

Source: Adapted from Jodha (1991)

Data sheet used for recording the reasons for changes in land use area, intensity and soil and veld degradation in the 12 degradation workshops

ANNEX 5

		Reasons for LUT Area	
Land Use Type (LUT)	Area Trend	Decreasing	Increasing
Cropland			
Grazing Land			
Forest (Commercial)			
Conservation			
Settlements			
Other			

		Reasons for LUT Area Intensity	
Land Use Type (LUT)	Area Trend	Decreasing	Increasing
Cropland			
Grazing Land			
Forest (Commercial)			
Conservation			
Settlements			
Other			

		Reasons for soil degradation	
Land Use Type (LUT)	Area Trend	Decreasing	Increasing
Cropland			
Grazing Land			
Forest (Commercial)			
Conservation			
Settlements			
Other			

		Reasons for veld degradation	
Land Use Type (LUT)	Area Trend	Decreasing	Increasing
Grazing Land			

Data sheet used for determining land use trends and status of natural resources during the 12 degradation workshops.

Name:	District:	Region:	Province:	% Favoured	
				% Marginal	

Land Use				Soil Degradation						Veld Degradation							
Land Use Type (LUT)	Area (% of district)	Area Trend	Intensity Trend	Type	Degree	Extent	Severity	Rate	Soil Index	Type	Species	Degree	Extent	Severity	Rate	Veld Index	
Cropland																	
Grazing land (veld)																	
Forestry (commercial)																	
Conservation																	
Settlements																	Total for both Indices
Other																	
Total Area	100%	Total soil degradation index								Veld degradation index							

Area Trend

- **-2**: rapidly decreasing (>2% per year)
- **-1**: decreasing (0-2% per year)
- **0**: stable over last 10 years
- **1**: increasing (0-2% per year)
- **2**: rapidly increasing (>2% per year)

Intensity Trend

- **-2**: Major decrease
- **-1**: Moderate decrease
- **0**: No major changes
- **1**: Moderate increase
- **2**: Major increase

Type of soil degradation

Water
- **Wt**: Loss of topsoil by sheet erosion
- **Wd**: Rill, gully, donga erosion

Wind
- **Et**: Loss of topsoil by wind
- **Ed**: Deflation hollows & dunes
- **Eo**: Overflowing (deposition)

Degree of soil (&veld) degradation

1: Light	Somewhat reduced productivity, restoration possible. Biology intact
2: Moderate	Greatly reduced productivity, major improvements required for restoration
3: Strong	Not reclaimable at farmer level, major engineering works required.
4:Extreme	Not reclaimable, beyond restoration. Biology fully destroyed.

Extent

- **1**: Infrequent (0-5% of LUT)
- **2**: Common (6-10%)
- **3**: Frequent(11-25%)
- **4**: Very Frequent (26-50%)
- **5**: Dominant (>50%)

Severity

Degree		Extent (% of LUT)				
		1 (0-5%)	2 (6-10%)	3 (11-25)	4 (26-50%)	5 (>50%)
Light	1	1	1	2	2	3
Moderate	2	1	2	3	3	4
Strong	3	2	3	3	4	4
Extreme	4	2	3	4	4	4

Rate

- **-3**: Rapidly decreasing
- **-2**: Moderately decreasing
- **-1**: Slowly decreasing
- **0**: No changes in 10 years
- **1**: Slowly increasing
- **2**: Moderately increasing
- **3**: Rapidly increasing

Type of veld degradation

- **Ls**: Change in composition
- **Be**: Bush encroachment (species)
- **Ap**: Alien plants (species)
- **Lc**: Loss of cover
- **Df**: Deforestation
- **Ot**: Other