ECOLOGY, POVERTY AND SUSTAINABILITY:
ENVIRONMENTAL PORTENTS AND PROSPECTS IN RURAL NAMIBIA

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Blessed is the person
Who makes two blades of corn grow
Where only one grew before.

- Bible

In the dry valley....
Fragments of our lost kingdom....
Under the fading shadow
of a dying star.

- T. S. Eliot 'The Wasteland'

Pula, Pula, Pula!

- Invocation from Botswana:
  Water, Wealth, Well Being.

The Unforgiving Land

Environment, at least as a social science or a political process, is about human beings as well as about ecology in the more narrow sense. To modify Adam Smith on the incompatibility of sustained national wealth and human misery - no ecological zone can be healthy and sustainable the majority of whose residents survive in misery and extreme need.

Neither the ecological nor the human condition context nor dynamic in rural Namibia is an easy or a happy one. Both are unforgiving of error and past errors have been major and long persisted in. Basically the ecology is that of semi-arid to desert lands - fragile, easy to damage, hard to restore. The human condition is - for most rural Namibians - one of severe to absolute poverty in an institutional context which (even post-apartheid and its extended family) offers no easy ways out.

These two unforgiving realities - of ecological erosion and of human misery - interact. In the North more people on the same land area have pushed

beyond the margins of ecological sustainability of soil and of vegetation. Need, not greed, is the destructive dynamic. In the Centre and South, ranches built on underpaid labour still do not earn plausible returns on resources used and in many cases have pushed the ecology to or beyond the tipping point into secular degradation. To argue about whether worker need or rancher greed/need is the key problem is to miss the basic reality: no ranching system which cannot provide decent living conditions (including income and access to basic services) to its working households, a positive return on capital used and production patterns ecologically friendly enough to halt/avert secular degradation can be sustainable. In this case it is not either/or; unless an answer can be found in terms of "and" the end results will be "neither/nor".

Not all choices are of that type. There are trade-offs. Namibia is water short - or at least most of it is inherently short of physically and economically accessible water. The total reasonable urban household, mining, industrial, rural household, livestock and crop demands is beyond economically viable and ecologically sustainable flow levels. Hard choices have to be made by use and by location. To seek to avoid them by drawing down stocks (as appears to be happening now in the Kaarstveldt and other artesian areas) is to delay facing the unforgiving limits of the ecology and, by so doing, to make the achievement of humanly acceptable and ecologically sustainable accommodations harder.

The same criticism can be made of certain schemes - partly implemented or sometimes proposed - for relaxing or escaping from ecological limits. One is medium to large scale irrigation. In a climate characterised by high transpiration and in arid mineralised soils it is a highroad to salination and land destruction especially when basic water flows are not adequate to allow flushing out salts annually.

Proposals for deep ploughing, levelling with heavy equipment and setting up standard irrigation channel systems have been made in respect of the Oshana country. Given the specific, complex structure of the natural ridges and channels this would be much more likely to reduce than enhance soil fertility. Worse, the deep ploughing and use of heavy equipment would carry a high risk (near certainty?) of cracking the relatively shallow hard-pan underlying the soil and surface sand thus releasing the deep salt water reservoir beneath it and creating a new and larger analogue to the

Etosha Pan. The danger of acting on ill-considered and virtually ecological damage untested proposals in the context of an unforgiving environment and of the need for extreme caution in handling risks of irreversible damage could hardly be better illustrated.

Wildlife and mixed farming are competitors for (alternative users of) land, vegetation, water. Certainly both uses can, and should, co-exist in Namibia as a whole and, indeed, some areas suitable for wildlife (e.g. Skeleton Coast National Park, Etosha Pan) are pretty nearly totally unsuitable for any other use. But at the margins there are trade-offs and choices and the worst course is to pretend they do not exist and thus to make them accidentally, fragmentarily and ultimately more by inaction than by conscious decision.

For example, there is a sound wildlife ecology case for a corridor connecting the Skeleton Coast wildlife zone to the Etosha Pan one. Part of this corridor would require curtailing present grazing areas. Further, it would limit potential expansion south of grazing - or mixed farming - areas through boreholes to serve areas with vegetation and some rainfall but no surface water. This is not an easy decision because the Oshana country is disastrously (in terms of ecological damage and of human poverty) overloaded and extending it south on the east side (and on the less contentious west) is attractive and potentially ecologically sustainable. But for both Namibian and global wildlife heritage reasons (including potential employment and revenue gains to Namibians) restoring and enhancing the Northern wildlife belt from the Skeleton Coast through Etosha is a serious proposal deserving serious attention.

Pula, Pula, Pula!

But it is undesirable - as well as usually unnecessary - to specialise in the role of Cassandra. To purvey a prospect of unrelieved doom and gloom is to increase the probability of being doomed to that future by distracting attention from and demobilising efforts toward ways of averting disaster whether ones readers accept and despair or reject and ignore.

Namibia's ecology is damaged. It is not irrevocably destroyed. There are limits to ecological carrying and self-regenerating capacity, but they can

be increased and are not yet - in most cases - hopelessly surpassed. Judging from conversations, the press and the Independence Day Parade floats, ecological concern in Namibia is real and fairly widespread, an enabling climate necessary, even if not sufficient for ecological protection and regeneration. That is a climate which does not exist to the same degree in many other countries.

Similarly the unacceptability of the human condition of a majority of Namibians is not simply perceived, but is a priority in respect to governmental and - perhaps less uniformly - civil society action. The returning war migrants and the dislocated persons of town exurbs and the Oshakati-Ondangwa-Ongwediva triangle are visible literally and as public concerns. So are the conditions under which many ranch workers exist and - perhaps less widely - the deadly interaction of human need and ecological degradation in much of the North.

What is needed now is the development of a coherent, articulated, informed strategy in relation to sustainable environment which includes both the ecological and human condition strands. Because that will necessarily take time a set of preliminary guide-lines and caveats may be useful:

1. be cautious in the absence of clear evidence on ecological safety - delaying a safe gain is less damaging then incurring an irreversible loss;

2. where practicable halt ecological degradation now; at the least take action to slow it and set target dates for halting and beginning to reverse it;

3. give urgent attention to ecologically friendly means of increasing the livelihood sustaining capacity of both the small and the large scale farming/ranching sectors;

4. view trees-bushes-shrubs in the context of silviculture and farming/ranching systems (including their livelihood effects) not only from fuel supply, forestry and ecological preservation perspectives;

5. build up a national (and local) water flow/stock and potential augmentation inventory (inventories) and another of present uses as rapidly as possible to allow 20 year perspective programmes for water

development, allocation, charging and use and in the interim seek, at the least, to halt expansion of unsustainable national (local) uses;

6. in parallel to the above proceed with water use/supply/protection agreements with Angola, Botswana, Zambia, Zimbabwe and - when possible - South Africa in respect of border rivers and trans-border drainage/basin systems;

7. review available experience on large, medium and small scale irrigation with a view to determining sustainability and viability and defer any borderline large and medium scale expansion until clear evidence and analysis is to hand while experimenting/test projecting in respect to small scale and, probably, Orange River margin pump or weir schemes (small or medium);

8. evaluate shifts in production pattern and price policies (e.g. to encourage mixed farming, oilseeds, urban market "truck gardening", silviculture) in ecological and livelihood as well as physical supply and food price/food security terms;

9. collect data on experience and research in other SADCC countries with a view to adaptation and field testing crops - techniques - services - institutions for Namibian use (in respect to agriculture-livestock-silviculture generally but including ecology and food security);

10. recognise that, except for beef and karakul, rural production is not and will not be central to the macroeconomic dynamics of Namibia so that ecological viability and livelihood enhancing - not narrower physical or financial surplus - targets should be the central ones.

On that basis it is potentially possible to transit from "unforgiving land" to "Pula, Pula, Pula". If the first pula is read narrowly as rain, admittedly not much can be done, but if read as water then supply, conservation, and use are subject to major gains (or losses) from better and different management. Similarly wealth in the sense of riches is, in general, not attainable for most rural households but wealth in the broader sense of decent livelihoods and human conditions for those who live on the land is attainable as is their well-being consistent with well-being (sustainability) of the rural ecology.

Ecology - Elements and Threats

Looking at the ecological side it is relatively easy to draw up a general check-list of elements and threats but remarkably difficult to articulate - especially in a policy and programme focused way. The latter problem has at least three causes:

a) data is scarce, not readily accessible in any one or two places, full of gaps;

b) Namibia is not homogeneous so that to write specifically on land quality - use - carrying capacity - present situation future prospects/portents without specifying whether one is talking about the Kaokoveldt, the Oshana Country, the Okavango Valley, the Eastern Caprivi (itself arguably in three zones), the Otavi Highlands, Gibeon or the Orange River adjacent potentially irrigable zone makes no sense;

c. the ecological aspects cannot be abstracted from the human if one is concerned with future pressures and possibilities - creating an ecological paradise at the expense of rural residents is neither practicable administratively nor politically while sustaining rural livelihoods by ecological destruction is at best a short run expedient clearly fiscally (as well as ecologically) disastrous in the medium term.

The key ecological factors are land, water vegetation, air, sea and wildlife/"wilderness". The threats to them include overuse and pollution leading to, e.g. erosion, salination, fertility decline, quality degradation (in plant populations), desertification, poisoning (e.g. via polluted - including saline - water and airborne chemicals/radiation/dust), destruction of stocks (of fish or wildlife).

Of these the sea - i.e. slaughter catching of fish, shellfish and marine mammal stock problem - poses an important and specific problem. However, the ecology of Namibia makes it virtually totally separate from other rural ecology and livelihood issues so that it will not be treated further in this paper.

Air pollution's flashpoints in Namibia are Rossing and Tsumeb. Rossing is best seen as an environmental and occupational health time bomb which has been ticking away for over a decade. The air pollution downwind is very

visible at the level of dust and - presumably - also well known in its less visible, but more deadly, parallel of radiation. Water pollution is also a known problem, which may or may not be better contained now than in the past. The history of the relatively comparable USA Rocky Mountain/dry Southwestern Plateau uranium oxide mining/processing operations suggest present protective and pollution reduction measures - for workers, for downwind/downwater communities in the Arandis-Walvis Bay-Swakopmund triangle and for the ecology - are seriously inadequate. Because uranium oxide has a relatively high value per tonne, better protection - which might cost $.10 to $.15 per pound - probably is consistent with continued profitable operation even in the present parlous state of the world yellowcake market. But unless a local government - trade union - medical - ecological pressure group is formed, inertia, private partner interests and fear of tampering with Namibia's second most important single economic asset are likely to slow or block positive change. (Realistically the Rossing challenge has next to nothing to do with agriculture or rural livelihoods.)

The Tsumeb ecological pollution focus is the smelter. (There are other environmental health problems in the mines but largely focused on mine personnel not the general public nor rural ecology.) The smelter plume contains a variety of noxious substances of which the chief is sulphur. The dryness (usually) of the atmosphere limits the degree to which this descends as sulphuric acid but over 1,000 tonnes a year of sulphur particles are, in any form, ecologically unsatisfactory and humanly unacceptable. Technologies for sulphur (and other pollutant) extraction exist and are widely used. Their 'only' problem is cost - abut $.08 a pound gross operating and capital cost less $0.1 to $0.3 value of sulphur recovered for a net cost of $.05 to $.07 per pound and $0.30 a pound initial investment judging from Southwestern USA experience. With present somewhat recovered base metal prices and Tsumeb's return to profitability, these costs are probably just consistent with continued profitable operation but would very sharply reduce profits (half USA Southwestern smelters and associated mines closed in the 1980s - a period of somewhat lower prices than now - because they could not meet the costs of "clean air" laws and remain viable). Again the ecological problem - while presumptively affecting crops and herds - is not primarily rural nor agricultural so will not be addressed further here.

Wildlife/wilderness issues do affect agriculture but in somewhat special ways because the basic issue is normally what land should be dedicated to which. In most cases the two uses are not mutually compatible on the same piece of land. For at least many wilderness and wildlife areas the answer is fairly easy - agricultural/ranching potential is so low that the ecological, human and economic balances of advantage all lie with wilderness/wildlife.

It is at the margin that trade-offs arise. These are unlikely to be for small areas: in few parts of Namibia is the use of up to 5,000 ha to protect a scenic attraction likely to have a high agricultural opportunity cost and rarely is such a small area viable by itself for wildlife. The Skeleton Coast/Etosha corridor illustrates the nature of the real and difficult choices likely to arise and is probably the most quantitatively significant and temporally urgent of them.

But wildlife and wilderness areas do need to be protected and serviced - not merely zoned - if they are to survive. To the extent costs can be covered from visitor fees without the visitors themselves wrecking what they come to preserve, no inherent problem arises (Etosha is probably an example). To the extent it is argued that Namibian wildlife and wilderness are part of a global and national heritage which has claims on resources in its own right there are problems of priority to that heritage and/versus priority to survival and development needs of poor Namibians. One possible way forward is to argue coherently and to mobilise external resources on the basis that Namibians comprise perhaps one three-thousandth of humanity and most are among its poorest ten per cent. Therefore the larger, richer units of humanity should meet the bulk of the costs for preserving Namibia's wilderness/wildlife as a global heritage.

Game ranching is best considered as ranching not wildlife. The ecological case is that many pastures have better carrying capacity for game (who also are less damaging to vegetation than cattle, sheep or a fortiori goats). While possible to overstate, this case is broadly accurate of many semi-desert grazing areas. The convincing logical case that such game ranching is/should be economically more viable remains, unfortunately, problematic in practice. There are viable game ranches - especially in Namibia. But they are few in number, usually capital and skill intensive and - unless adapted - apparently unsuitable for the family household ranching/mixed

farming sector. Research and experimentation plus extension is worth doing but until sustainable, economically viable results are attained, enthusiasm for massive conversion from cattle or sheep to game should be restrained.

Human Enjoyment and Ecology

Production, distribution, power, population and poverty relations interact with ecology. This is particularly true of Namibia today and for at least two decades to come because non-rural sectors cannot supply livelihoods for the whole population so that "going to town" is not a solution to rural poverty (and would create concentrated environmental horror zones in and around cities and main towns broadly analogous to the present Oshakati-Ongwediva-Ondangwa exurban triangle situation). Indeed improving rural livelihood/access to services and housing conditions to avert tidal waves of in-comers to urban areas is a necessary strategic priority. Reconciling it with ecological damage reduction and reversal is not going to be easy, but pretending there is no such priority is likely to have even more negative environmental consequences.

Rural inequality characterised by cramming large numbers of households or fragments of households into small areas of often marginal land with next to no attention to raising household sector productivity is a recipe for growing environmental degradation (human and ecological) as population in these areas rises. That is the underlying historic dynamic of much of what South Africa described as "homelands" or "second tier authority" areas. So long as alternative livelihoods and houehold security systems do not exist for most of these people (and their descendants), the problem will remain and worsen even now after the ending of apartheid/'homelands'. The long run solutions doubtless lie in creation of alternative livelihoods and household security systems but the short and medium need to include changes to increase productivity and increase ecological friendliness.

These areas are characterised by need driven ecological degradation. Need for fuel for fodder, for crops to eat, for livestock to eat and to sell - need rising with population and, over 1967-1987 exacerbated by worsening urban employment and falling real remittance conditions - forces overcollection of bush, overcutting of trees, overgrazing, cultivating too

continuously with too little return of nutrient to the soil. In analysing and acting on this type of downward spiral two dead end roads need to be avoided:

1. seeking to enforce ecological sustainability by fiat and force - unlikely to succeed and certain further to immiserize poor people;

2. saying that the ecological damage is not the poor people's fault but the systems's (true enough) and that therefore nothing can or needs to be done (false, especially as the burden of the ecological damage will fall primarily on the next generations of poor people).

The large ranching/mixed farming sector initially typified the economy of greed - stolen land, cheap (de facto forced) labour, limited ecological awareness), proprietor levels of consumption vastly higher than those of workers which were near to or below the absolute poverty line, master-servant type labour relations. Reconciliation should mean not shaking fists (or more lethal weapons) over the past but it must not mean declining to analyse it and its heritage.

Worker livelihoods need to be raised and households reunited - for human and political reasons and also to retain a labour force. Subsidies (already unsustainably high counting capital grants, concessional interest rates, residence payments, special services, etc.) need to be contained; overstocking and under-investment in pasture maintenance and improvement needs to be halted. The issue is - how? There are no longer (and historically have usually not been) large profit margins to meet these costs. Ranch proprietors, in general, do not have incomes above the professional-managerial-medium sized entrepreneurial average and often have sizeable debt burdens and low cash balances. Clearly either income (cash and worker self-provisioning) must be enhanced or costs cut.

Routes which would reduce employment and raise capital intensity and scale are open to question economically and would make a serious negative contribution to the adequate livelihood creation priority. Turning the land back to 'traditional' ranching would lower costs, but also output, with very doubtful gains to worker livelihood. Work team based approaches (or conversion to Batswana model large and medium scale ranches) could be viable if adequate knowledge, experience and skills were available which -

at least for broad front conversion - they are not today. The status quo is not viable except in the very short run.

But some means toward an answer have to be found and acted on within 2 to 3 years. Ostrich and game ranches may chip at the edges but the basic answer has to lie somewhere in the livestock - worker provisioning crop - cash crop matrix.

Superimposed on these two long term problems is that of the rural war displaced persons. While the most visible - especially from a capital/major city perspective - may be those returning from abroad the majority of displacees - especially the majority of desperately poor people among them - are internally displaced people from the districts loosely describable as the Ovambo and Kavango rural areas. These at their 1989 peak numbered up to 300,000 whereas rural oriented external returnees probably are well under 50,000.

With peace and reconciliation (still evidently not fully achieved in areas adjacent to rebelos armados/UNITA zones of infestation) most of these people need to be able to return to their homes. Namibia cannot generate livelihoods for them anywhere else. But they cannot return without systematic enabling support - tools for agriculture and for house building, seeds, implements, household utensils, food until the harvest, core livestock to rebuild that aspect of mixed farming. And unless there are systematic family sector household friendly programmes for reversing tree/bush destruction and soil depletion their return cannot be made compatible with ecological stabilisation and sustainability.

Water: Supply Expansion, Conservation, Allocation

Water is Namibia's scarcest natural resource. It is also the one in which agricultural/non-agricultural trade-off issues are of immediate urgency and have major consequences.

There are two safe and sustainable sources of additional water - border rivers and the mid-Caprivi swamp. The basic problems are:

a. economic viability

b. allocation - given that the total additional supplies are far from unlimited.

To the extent that allocations are to mining and to urban uses the water will - on site - be high cost because the concentrations of users are far from the borders. About that little can be done, albeit it is a case for shifting urbanisation (more particularly urban production and employment) to the North and, to the small extent likely to be practicable, the extreme South. But for agricultural uses the nearer the user areas to the borders the better. This cannot be a sole criterion - soil suitability is also relevant, but on the face of it capital costs and transit losses should create a presumption in favour of water using agricultural development in the North and extreme South not in the central zone.

Water management agreements are urgently needed with Angola and with Botswana for the Kunene, Okavango and related systems/basins. These need to include watershed management (including forest protection, dams, etc.), flow level targets, national offtake minimum guarantees/maximum allowances. Because at present much of the potential is not used there is a real possibility for amicable agreement if data collection and analysis is begun now and negotiations in - say - 1991.

Similar agreement in respect to the waters around the Eastern Caprivi Strip - with Angola, Zambia, Botswana and Zimbabwe - is equally desirable but less urgent because it is unlikely that developments in any state over the next decade could prejudice the rights of other users and because the viability of substantial irrigation in Eastern Caprivi is still less than clear-cut.

Orange River water right negotiations are likely to prove difficult. South Africa has a severe water shortage. Therefore, any South African government (not least a post-apartheid one) will be concerned to limit Namibian offtake. That offtake is now very small because the former occupying power blocked almost all recent applications for pump or other schemes on the North Bank while developing an irrigation zone at Uppington to the South.

The immediate priorities would appear to be:

a. securing preliminary assessment of technical and economic feasibility of pump scheme, weir and/or larger irrigation schemes drawing water from the Orange and of plausible requirements;

b. estimating total Orange River flow (pre diversions in Lesotho from the Orange to the Rand) and determining what per cent Namibia as one of the three Riparian states can plausibly demand - say 10% or 5%? (On the basis of share of the three states' population it would be about 5% but Namibia - especially Southern Namibia - arguably has less alternative sources than South Africa.)

c. publicly and formally asserting Namibia's rights as an Orange River Riparian state. (This means rejection of RSA's claim to a North Bank boundary. That claim rests on the fact that German colonial land claims were precisely that - they did not state water boundaries. In practice in the Cameroon and Tanganyika cases the Germans and British colonial authorities used the "thalweg" or middle channel of the river or lake as the water boundary.)

d. issuing some Orange River water abstraction licenses soon and beginning operation of at least a few new pump schemes plus, perhaps, expansion of the Oranjemund one. (South Africa is unlikely to choose to make a casus belli of such action.)

e. request both Lesotho and South Africa to negotiate a permanent - or at least an interim agreement. (And secure expert negotiating advice. Swaziland's experience may be instructive in certain positive and negative aspects, albeit in that case South Africa accepted from the start that Swaziland had some downstream rights and there was already substantial historic offtake.)

While draining the Middle Caprivi swamp (and perhaps irrigating into East Caprivi with the offtake?) would appear to be sustainable and not evidently ecological vandalism (unless a special case for that particular swamp's ecological uniqueness and importance can be made out), no action appears urgent. It is totally unclear what optimum uses for the land would be; whether and when it would be viable; what the capital cost would be and how it could be mobilised. At most beginning an ecological and a pre-

feasibility drainage and land/water use study in 1992 would appear appropriate.

Whether damming or otherwise collecting runoff water is a safe additional source is a contextual and empirical question. To the extent it would otherwise flow - e.g. - directly into areas of the Namib and Kalahari with no vegetation or animal population probably yes. But if it either provides seasonal water to vegetation/animals or recharges underground water tables there is a clear trade-off. Since physical water storage and movement costs (notably evaporation) are high, it is not self-evident that there is a case for systematic damming of every seasonal watercourse though there is for some.

The most vexed problem relates to borehole, well and pumped spring water. In these cases pumping can for a time exceed recharging but at the price of lowering the water table. Determining when the sustainable offtake level has been passed is not easy - except in gross overdrawing cases - because of national, regional and local drought cycles. The logical policy is one of prudence:

a. if it is likely but not absolutely certain that offtake secularly exceeds recharging then no new or expanded offtake should be allowed (except for local human consumption) until a definitive flow/stock/offtake/recharge analysis is completed. This appears to apply to most of the Kaarstveldt and some lesser artesian areas today. It is better to underuse for a few years than to face a future problem of cutting use below recharge to restore water tables. And any additional investment made prior to discovering the need to freeze or cut offtake will be wasted;

b. where offtake clearly is grossly above recharge now, move at once to phase down offtake - phased parallel to bringing in "outside" water where this is economically feasible;

c. if present offtake clearly is sustainable, but the maximum sustainable level is in doubt, allow limited additional offtake while giving priority to a definitive study of sustainable offtake. This may be relevant to certain areas south of the Oshana country and east/southwest of the Oshana pan. In those cases preference should be given to family sector household use (including livestock).

Desalination is - barring major technological breakthroughs - not relevant to agricultural (or scattered rural village/homestead) use for cost reasons. It may be relevant for selected towns, industries or tourist sites on the coast.

Irrigation is not a substitute for water. That may seem obvious, but there have been irrigation programmes which built up reservoir and user capacity far above poor rainfall flow levels and thus made irrigated agriculture almost as rain dependent as rainfed, especially if below average rainfall periods exceeded on year. Examples exist in Zimbabwe.

Large scale irrigation in Namibia is unlikely to be viable except from border rivers or the Middle Caprivi Swamp. (The Oshana Country could be described as large scale natural irrigation which might be augmented by diversion of Kunene water into the system, but this is in effect a border river case.) Even then viability is in doubt despite recent sugar estate proposals. Before risking its own resources (including guarantees and subsidies) Namibia should secure far more viability (and even feasibility) analysis.

Medium scale irrigation from pump schemes drawing on border rivers (and the Okavango) clearly can be viable albeit where, for what crops, under what techniques, requires further study. For the family sector there may be a case for co-op or public sector pumping units and main channels selling water to household units. Whether medium scale irrigation on the Hardap/Mariental model is economically viable or - given salination problems - even sustainable ecologically requires further study of existing projects before new ones are initiated.

Boreholes are unlikely in most areas (the Kaarstveldt including Otavi Highlands/Tsumeb and some other artesian zones may be exceptions) to be an economically viable source for irrigation of substantial areas. The exceptions are likely to be in cases in which rain and natural surface water provide most of crop needs and only relatively short seasonal or drought year topping up from pumped or artesian underground sources is needed.

Spot irrigation in basically ranching units (e.g. "kitchen gardens", fruit, vegetables, limited grain) for household self-provisioning may be viable. In this case the water for crops is a joint product or by-product with that

for human and livestock use and - subject to offtake limits - may have a low incremental cost. There is an urgency in ascertaining what the empirical realities in different districts are as such additional food output is one possible route to raising total ranch cash sale and worker consumption output value, such increases could help bridge the conundrum of unacceptably low wages, unacceptably high subsidies and - for most ranches - marginal present unit profitability.

Water pricing (and user facility offtake limitation) poses a series of difficult questions for Namibia. A - controversial - set of principles (or rules of thumb) might include:

a. full cost (including depreciation and interest on capital cost) pricing to mining, manufacturing and commerce. This is crucial to avoid distortions of uses and of location in the context of physically scarce, high cost water. If specific mines or industries or towns can make a case for subsidies, this should be specific to the unit and transparent, not general and hidden in the water price/budget;

b. cross subsidisation of urban household water prices via an inverse step tariff (i.e. higher charges above some threshold level because car washing and urban gardening are consumer amenity goods, unlike basic drinking/cooking/cleansing water) with some charges (perhaps on a neighbourhood user committee basis) even for stand-pipe water;

c. partial subsidisation of rural household water and of small ranch/mixed farm livestock water. Overall the goal should be to recover at least recurrent/maintenance costs but this needs to vary from district (or sub-district) to district in relation to total water cost and lowness of income. Again innovative use of water user committees to collect funds and to provide labour/routine maintenance should complement or substitute for more usual fee systems;

d. full cost pricing for commercial ranches/farms served by publicly financed water supples, e.g. FNDC or other large ranches and Mariental/Hardap irrigation plots. When (a) this charge would force closure of the unit and (b) there is a clearly defensible social or broader national economic case for keeping the unit in being, a flat sum subsidy flat not per unit of water used to encourage water conservation should be paid. For example, Mariental/Hardap could not

bear full cost pricing; it arguably has experimental/demonstration value; it is not clear there are alternative uses for the water. Therefore, pending review, lump sum subsidies paid from the Treasury to the scheme may well be justified at the same time as full cost water rates;

e. strict licensing (including some form of monitorable offtake ceiling) on ranch-farm-other enterprise extraction of water from own facilities unless there is no present or near term limit to withdrawals from that source. A "grandfather clause" approval of recent past offtake levels may be necessary as a starting point (subject to later review) but new or increased offtake proposals should be strictly monitored especially in borehole areas with secularly falling water tables where - in general - the applications should be disapproved.

Clearly price is not an adequate sole policy instrument. But for commercial enterprises and for urban areas as a whole it is hard to justify subsidising a scarce resource with an incremental capital and operating cost above average cost (and present charges). Subsidisation should be targeted to poor urban households and to household sector rural families in water charges and to enterprises (rural, mining or urban) which can make a case via transparent general subsidies (not water rate concessions). Furthermore, while enterprises should be encouraged to produce their own water (which full cost pricing for public water sales will do), their offtake must be controlled because sources are limited and in the absence of control a combination of "first drilled, first served", more and more wells producing less and less per well and rapidly falling water tables is highly likely.

Vegetation: Trees, Bushes, Pasture

Namibia faces three major and two secondary environmental degradation dynamics in respect to vegetation:

1. degradation of pasturage from the interaction of overstocking and drought cycles;

2. denudation of shrub, bush, tree cover especially in the densely populated northern areas as a result of household fuel and pole

requirements and - secondarily - levels of stocking and intensity of cultivation;

3. rapid reduction of tree and large bush cover to supply urban household fuel requirements;

4. commercial and artisanal forestry cutting without replanting;

5. human and livestock presence in/entry onto exceedingly fragile ecological environments.

The dominant dynamics driving this pattern of ecological and human condition degradation are human population, animal stock levels, drought and - in the past decade - war. The ecology/poverty interaction and the dominance of need or mixed need/greed factors are evident. Only in the case of some of the forestry (including the war looting of trees and trophies) and the richer ranches (which on the whole have better pasture conservation and safer stocking levels - not worse) can pure greed be put forward seriously as being dominant.

To approach the challenge as primarily one of forestry or of trees as normally defined is misleading. Pasturage is at least as important as trees-bushes-shrubs and these are by no means limited to trees. Fuel, artisanal and household building and fodder are the main users (or denuders) of trees-bushes-shrubs, not commercial forestry. Pasture for stock, fuel and poles for rural households, and fuel for low income urban households are important to at least 1 million poor Namibians whereas forestry will never be a major sector in economic terms nor in livelihood generation.

Pasture degradation flows from overstocking absolutely or relative to carrying capacity during drought cycles. It is reportedly prevalent in marginal large ranching zones, the densely populated northern areas, barren southern ex-'homelands' and (perhaps less uniformly) the ex-Omaheke desert areas developed for grazing by the post-War of Resistance Herero refugees. A detailed review and survey (perhaps from analysis of satellite picture blowups is needed to pin-point extent and location). In a different sense war clearances and abandonments may have resulted in bush and coarser grass growth which also damages pasture cover.

The interaction with drought occurs when stock sales (or deaths) early in the drought cycle do not keep pace with decline in sustainable carrying capacity and restocking after the drought proceeds too fast and with too little investment in pasture regeneration to allow recovery. It is possible that the poor price/cost position and the security/political uncertainties following the last drought cycle have delayed restocking to a degree helping natural regeneration. On the other hand they have surely also cut investment in regeneration.

In respect to large ranches the programme outline for restoring and maintaining pasture is fairly clear:

a. produce (or check existing) data on carrying capacity in normal years and requisite cutbacks during droughts;

b. monitor actual herd levels and provide financial penalties for sustained, significant overstocking;

c. review data (including Botswana, Zimbabwe data) on methods of pasture regeneration and upgrading with full field testing (at government cost) on selected ranches;

d. provide partial grants and/or full soft loans for regeneration on degrazed or at risk units;

e. carry out an exercise similar to "c" in respect to stock level, "paddock" rotation (with and without wire fences - without is more labour intensive but may or may not be more costly if fences are not subsidised by capital and/or interest grants) including recent innovations in Zimbabwe, Botswana and Zambia;

f. provide effective extension based on "e" (including any new methods found desirable - present ones are presumably extended by existing service) and impose financial penalties for serious mismanagement.

Such an approach should halt degradation and begin regeneration within two years. It would provide a breathing space for data collection and analysis toward a longer term solution.

For 'traditional' ranching and mixed farming areas a somewhat different approach is needed:

a. broaden carrying capacity and rotation of pasture studies and extension services from the large ranch sub-sector to include all livestock growers (the Zimbabwe and Botswana approach);

b. encourage lowering stock levels where excessive, as well as investment in pasture improvement and rotation systems by extension and partial grants/soft loans, plus providing a last resort/fair price market for culled stock until/unless there is a competitive, accessible commercial stock buying network to do so;

c. explore the possibility of local government (at village or herding community level) imposition of sanctions against those keeping too many stock and/or practising bad pasture maintenance/rotation techniques. Central government penalisation is unlikely to be very effective and is certain to be deeply resented judging by experience elsewhere in Africa. (A functioning system exists in several Northern States in Nigeria - at quasi-traditional local government level).

A necessary complement to the basic small scale/mixed ranching pasture regeneration and reduction of stocks in overused areas is extending usable grazing areas. This can be done in some cases by selective use of boreholes in adjacent areas with some vegetation/rainfall but no surface water. However, care must be taken to avoid the disaster created by the Club de Sahel in its comparable programme in West Africa which ended by raising, not spreading, herds and shifting them during good years to areas whose vegetation cover was then overgrazed and collapsed totally in the early 1980s drought cycle. New areas should have firm stock ceilings from the start.

In certain 'traditional' ranching areas serious equity problems arise. (Examples include the ex-Omaheke and Rehoboth). Very unequal access to grazing rights and herd sizes combine with limited sustainable carrying capacity to prevent escape from absolute poverty for the lo or nil herd majority of households and/or to ensure overstocking and degradation. Clearly the issue is potentially explosive but the only environmentally (or ecologically) valid answers are absolute ceilings on herd size or absolute reduction in numbers of households.

Household fuel and building pole damage to tree-bush-shrub stocks have causes similar to pasture degradation in the small ranching/mixed farming

sector. This is hardly surprising as the same households facing the same poverty pressures are acting on the basis of short term survival necessity in both instances.

The degree of present damage varies widely. It is appalling in - e.g. the central Oshana country and certain southern rural slums, e.g. Bethanie, used by the past regime as human dumping grounds. It is moderate in some less arid and less populated areas - e.g. parts of Eastern Caprivi. However, with rising population on the land (plus growing urban fuel demand) and repetitive drought cycles, the danger of further degradation is national not local.

No response based primarily on coercion - forbidding cutting of vegetation or forced relocation of families - can be humanly acceptable nor can it be politically sustainable nor administratively practicable. Equally, rushing about planting (paying people to plant) trees without prior study of local contexts and building up community support is unlikely to do much good.

An initial programme (or set of district/zonal programmes) might include:

a. survey of present position (possibly from analysis of blown up earth satellite photographs) and - to the extent possible - trends;

b. development of extension programmes (backed by appropriate traditional of field tested seeds/seedlings) to encourage household and village woodlots, windbreaks, farmstead groves;

c. operating "b" on a modern silvicultural focus taking into account human food, fodder, poles (for building), thatch and fuel uses of individual and combined trees-bushes-shrubs. (Such multiple uses do characterise past Namibian household economies/livelihood especially, but not only, in areas near Kunene and Okavango rivers);

d. utilising tree planting (especially for urban fuel supply but also for soil conservation, watershed protection, village fuel/building materials) as a seasonal, labour intensive supplementary employment programme (e.g. up to 2 months per person employed at R 3 to 4 per day with 50% or more of person months to be female) to serve both ecological regeneration and poor household human environmental rehabilitation objectives;

e. encouraging local government/communities to engage in 'community forest' and 'pasture shrub-bush-tree population' management and protection and to exert social pressure sanctions on reckless destruction of vegetation;

f. studying experience on poor household silviculture and community forestry in, e.g. India, Ethiopia and Tanzania with a view to adaptation and testing in Namibia.

These steps are probably at best a temporary damage halting/partial reversal stopgap at least in the central Oshana country. There the population/land ratio (taking fertility into account) is probably well above long term environmental sustainability. But they should buy time to be spent on longer term transformations, including achieving other rural or urban livelihoods for some of the families now resident in overcrowded Northern (and Central/Southern rural slum) areas.

Urban fuel requirements cannot in the long term be met fully from sustainable wood production. To date they seem to have been met primarily by a cancerous destruction of wood stocks in growing circles around cities with resultant increases in poor household real fuel costs and longer and longer hauls for wood which tend to concentrate gains in buyer-transporter-wholesaler oligopolies.

To date there are no cases in SSA of achieving sustainable or even stable real cost low income urban household fuel supplies. Greater efficiency in wood use has limitations as does enhanced rotational (self-sustaining) production while alternative fuels either have high initial capital costs (e.g. electricity, bottled gas) or fuel bills (e.g. kerosine) or both (e.g. coal) and some - especially coal - pose ecological questions and others safety ones (e.g. kerosine and, to a lesser extent, bottled gas). An initial Namibian programme package could have two clusters - demand containment and sustainable supply expansion:

Demand containment (especially Windhoek)

a. encouragement of use of electricity for cooking/lighting by low connection charges and low rates for small consumers (cross-subsidised by higher unit charges to large consumption households) as well as by market access to low cost small 2 or 3 'burner' hotplate type cookers;

b. analogous promotion of bottled gas;

c. analysis leading - if results are positive - to promotion of sawdust, coal and mixed heating briquets (and low cost artisanal stoves for them) to supplement/substitute for wood;

d. study of whether a low cost (i.e. recovery of initial capital cost in fuel saving in 6 months or less), improved efficiency, artisanally producible stove is feasible and if so its promotion (including initial support to workshops producing it) for a limited period.

Sustainable Supply Enhancement

a. identify suitable (ecologically, economically) trees for rotational woodlot/plantation production by district/zone;

b. provide extension advice to potential growers (rural family sector households, ranches, co-ops, mining companies) and back this up with partial establishment period capital grants and/or soft loans (possibly channelled via a seasonal employment programme of the type discussed in respect to household/village sector tree stock regeneration);

c. limit public sector 'production' to tree planting for ecological and watershed/reservoir protection and - if seen as necessary - a limited number of small, 'demonstration' mini-plantations;

d. monitor whether moderate cost, competitive purchasing, transporting, wholesaling channels do emerge as a result of market forces and - if not - provide technical assistance and soft loans/loan guarantees to co-op or small business purchasers-hauliers-urban marketers.

Commercial forestry - concentrated around Rundu except for a few (presumably 'self-sustaining') pit prop plantations associated with mines - is almost certainly cutting at unsustainable levels and failing to exercise proper forest management techniques. It is, however, a lesser and more limited area ecological destroyer than the previous three simply because Namibia has never had (and barring rather unlikely climatic or water availability changes, never will have) large forest areas. To the extent it is dominated by medium sized sawmills or full time established artisanal pit sawyers, standard control and extension measures should be applicable. So far as human environment/poverty issues are relevant they probably turn

more on the sustained supply of reasonable cost inputs into construction, carpentry, furniture production than on livelihoods in forestry itself.

However, as there is a forestry department and a number of para-professional foresters trained abroad, an initial programme should be set up speedily including:

a. setting logging limits and logging charges;

b. encouraging replanting via multi-year concessions renewable if well managed/revocable if overlogged and partial rebates of logging charges toward agreed replanting programmes (not directly applicable to pit sawyers);

c. conducting a detailed forest inventory (again probably starting with analysis of satellite photo blowups) and collection of modern forest management/regulation techniques (including via the relevant SADCC unit in Lilongwe);

d. on the basis of "c" revising the initial measures taken at "a", "b"; probably instituting seedling production and distribution; possibly creating forest reserves with no or highly selective logging allowed.

Rather more detailed and technical discussion of fuel and forestry issues is to be found in the relevant chapter of Namibia: Perspectives Towards National Reconstruction and Development.

The fragile ecological zone intrusion problem is basically a wildlife/wilderness one as the relevant areas - e.g. parts of Fish River Canyon and coastal belt - are hardly of much value for livestock let alone crop or tree production. The danger presumably comes primarily from tourists. The cure probably lies - at least in the short run - in ensuring that all such areas are gazetted as national parks and/or reserves with access by all persons (except present residents, e.g. San) allowed only by permit; that permits are limited in number and carry high enough fees to provide for accompanying (necessarily small) parties with a guide. Recent past damage has - reportedly - been severe but apparently related to 'spare time' activities of the former occupying power's 'security' forces so the immediate risk of further damage may not be massive.

The Land - Overuse and Undernourishment

Namibia's land suffers from wind and water erosion. This is - with the exception of coastal dune movements - apparently moderately limited in area and/or scope and - except to the extent it relates to water or pasturage or tree-shrub-bush ecological damage - not readily controllable in the short run. For example, no general ecological protection programme could have saved the Finger of God - even setting aside the views of those who saw its fall as a symbol of the withdrawal of the "Mandate of Heaven" from the former regime. Grouting with special concrete and coating with a resin skin might have, but at a cost limiting the conceivable frequency and extent of application.

The land degradation dynamic interacts closely with those of water and vegetation. Therefore in one sense the water and vegetation analysis and programme explorations above are as important to land protection as what follows.

Land quality reduction - especially in the densely populated areas in the North - results from too frequent cropping draining nutrients from the soil with limited or no replenishment. Degradation of vegetation exacerbates this process by furthering limiting nutrient return as does burning (rather than digging in) of crop plants after harvest. Livestock usually take less nutrients (via grasses) from the soil and return more via manure - unless it is collected and used for fuel as may happen with tree-shrub-bush degradation.

This is at present a poverty cycle with growing numbers of people wedged onto a fixed (and relatively low natural productivity) land area. Its extent will expand if cropping is broadened and intensified, e.g. in Caprivi, Okavango Valley and Otavi Highlands albeit in those cases the longer term poverty consequences will, initially, be less visible.

The answer does not lie in "traditional African practices". This is not because the rural African family sector does not have a working grasp of sustainability or a respect for the land. Neither is it because the techniques were unsound "before the Europeans came". Rather it is for the reason that they turned on relatively long rotations with a low ratio of cropped to resting years. That approach requires a low household/land ratio which is no longer possible in much of the North.

Economically viable, soil sustaining, intensive cropping (low rest to crop year ratios and high crop output per hectare) requires direct return of nutrients to the soil. Digging back unused portions of crop, increasing tree-bush-shrub population, use of livestock manure can contribute something but often not enough. Selective use of chemical fertilisers is necessary. (Organic gardening in the north is on balance hi tech, lo yield per hectare and hi cost per kilo produced. These are not the ideal characteristics for either household self-provisioning or urban food supply crop production in Namibia.)

It is difficult to devise programmatic steps at present for two reasons: first, black small farm households are largely outside the experience and coverage of the extension service and second, even in respect to large, white farmers the extension service's priorities and competences have focused on livestock. That said, certain elements toward a programme can be identified:

1. broadening the extension service to encompass all farmers and adapting its techniques to ensure that it is user friendly for small farmers:

2. strengthening the crop oriented component of the service and its back-up research (including collection and adaptation/testing of research and extension results elsewhere in the Region, e.g. via SACCAR in Gaborone);

3. analysing possible (ecologically and economically) crop rotations including crops (e.g. some oilseeds, legumes, fodder plants) providing natural restoration of soil nutrient levels as well as potential gains from better use of manure and crop by-products (e.g dead plants). Extending positive results achieved from the analysis and testing;

4. securing relevant data from comparable ecological zones, backed by local testing, on response to chemical fertilisers in different Namibian ecological zones and channelling results into extension advice;

5. providing initial use incentives for selected fertilisers through limited period free "starter packs" either as a self-standing project or (as in Zimbabwe) in conjunction with introducing/encouraging new crops.

A special problem does arise in respect to soil nourishment and to human animal disease control. The techniques needed for these purposes are not usually ecologically neutral.

Likely levels of fertiliser and pesticide/herbicide application do not seem very likely to have serious water pollution risks. However, this may not be so valid an assumption if well sources are close to the surface and draw from mini-aquifers nor in respect to low flow seasonal streams and to water passing through irrigation schemes such as Mariental/Hardap.

The danger to users is significantly greater. For fertilizers and some pesticides/herbicides clear labelling and extension demonstrations are needed and can be adequate. For other pesticides/herbicides either controlled use by trained personnel or bans are the realistic options and for the most dangerous pure bans. As an initial guide to which is which and what to do about it, data should be secured on USA and on Zimbabwean experience and regulations.

Animal disease control (particularly in respect to tse tse flies) and human disease control (particularly in respect to anopheles mosquitos) are occasionally challenged by ecologists on behalf of the flies and mosquitos. The present author admits to a bias in favour of young children (the main victims of malaria) and small ranchers/mixed farmers (whose livelihoods are most at risk from tse tse flies) and therefore rejects these arguments out of hand. Similarly, the bush clearing often needed for permanent tse tse control is normally not inconsistent with ecologically acceptable ground cover and the protection of a thicket for ecological reasons when it is an actual livestock and potential human sleeping sickness focus is presumably not appealing to any but the most single minded of ecologists.

However, the chemical problems are very real. The ones which are effective and affordable range from pretty noxious to potentially catastrophically so. The potential victims are the people and livestock to be protected plus wildlife so that this problem cannot be brushed aside. The best that can be done is to use the lowest possible dose of the least noxious effective and affordable chemical under the greatest practicable safeguard. In respect to the tse tse fly there is a body of Southern African experience albeit the evaluation of the use - under tight control - of dieldrin is incandescent from two directions with ecologist objections to

its use at all and aid agency/livestock scientist/sprayer near explosions over how restrictive safeguards have been.

"Pula, Pula, Pula!" ?

The previous sections do not constitute a complete ecological and human environmental programme for rural Namibia. Their aim is much more modest:

1. to demonstrate the negative and systematic interactions of ecological degradation and human poverty in Namibia;

2. to identify the most serious environmental/ecological risks and downward dynamics in rural Namibia today with special reference to agriculture;

3. to suggest how one can ask questions about these risks/downward dynamics which direct attention toward humanly and ecologically sustainable answers - and to ask some of those questions;

4. to suggest some initial, partial answers which - if implemented - could improve present environmental/ecological dynamics and buy time for articulating longer term strategies based on additional data and analysis.

Clearly that is not enough to announce the attainment of "water, wealth, wellbeing!" but it should be a first step in that direction. Ecological sustainability - especially in a context of pervasive rural poverty and a fragile natural environment - is only attainable at the end of a long journey. To begin that journey requires taking first steps now (precisely because the journey is long and the time not so long) and taking them in the right direction (because wrong steps may be virtually unrecoverable). It is as a pointer to some of these steps that the present paper is presented.

Author Note

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