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Changing Ecosystem – Social System Links and Future of Drylands in India

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Abstract: This paper synthesized the inferences and understanding of various studies and observations focussed on nature-society interaction patterns, and their driving circumstances and consequences in the arid and semi-arid areas of India. Faced with high risk-low productivity situations in dry lands, the communities have histrocially evolved various resource use and produciton practices. They reflect a two-way adaptation process, i.e. adapting human needs to limitation and potential of natural resource base and adapting or amending nature (as far as possible) to increasing human needs. This two way adaptation process has been weakned due to the side effects or modern changes rooted in state policies, market forces and various socio-economic changes. The paper suggests the needs and approaches to identify and integrate the elements of traditional adaptations into future strategies for development of drylands. Key issues are covered in the paper and summarized under tables.

Key words: Dryland, adaptation, traditional systems.

This paper looks at the farming systems through a lens of ecosystem social system links in drylands. This is so because in a practical sense farming system represents a complex of diverse and interlinked land-based activities shaped and shifted by interactions between ecological and social processes characterizing particular region.

The paper reflects on the possible future scenario of drylands in India and builds upon the visible changes in ecosystem-social system links in dry tropical regions of the country. Rather than going into finer definitions, it uses the term ecosystem to reflect on relevant components of natural resources and their imperatives; and on social system as relevant to socio-economic activities and processes linked to management and usage of natural resources. As its central thrust, the paper deals with natural resource-friendly traditional patterns of resource use or farming systems in dry regions; their gradual decline as well as contributing factors under the changing present-day scenario; and finally the possible approaches to redress the situation. The paper draws upon the evidence as well as broad synthesis of inferences and understanding generated by large number of field studies and on the spot observations for over 20 years in arid and semi-arid areas of India (and to an extent Africa), while working with different national and international research institutions including CAZRI (Central Arid Zone Research Institute, Jodhpur), ICRISAT (International Crops Research Institute for Semi-Arid Tropics, Hyderabad) and AERC (Agro-Economic Research Centre for Gujarat and Rajasthan). The basic argument is that: drylands due to specific biophysical (including climatic) conditions, generally, offer limited and risky earning opportunities for the people; to sustain and enhance the

same, the resources have to be used judiciously. The rural communities learning this by first hand experience through trial and error over time, have evolved various adaptation measures reflected through different features of farming systems to survive and to grow under the constrained circumstances of drylands.

The adaptation measures included technological (folk agronomic, folk engineering practices and other context-specific diversified farming practices) as well as institutional arrangement (collectively enforced norms and practices) to restrict or adapt their resource usage systems to what nature could sustainably permit and wherever possible, amending or upgrading natural resource base through water harvesting, agroforestry systems, etc., to meet increasing demands. The involved two-way adaptation strategies worked well with low population pressure, subsistence orientation of activities, and limited external demands (due to poor infrastructure and market links).

The above arrangements, although visible in some areas even today, broke down with increased pressure of population, negative side effects of external links and interventions, which made the farming systems or rather underlying natural resource usage systems highly demand-driven instead of being determined by the availability and supply as in the past.

To redress the situation, the paper pleads for understanding the process of change and identify its key drivers, along with their imperatives. The responses to these changes could build upon the rationale of traditional strategies along with the new knowledge and experiences generated through formal R&D and management systems as well as experiences of recent successful initiatives, leading to sustainable resource use in dry regions.

Drylands: Broad Biophysical and Social Dimensions

The drylands in tropical arid and semi-arid areas of India are broadly characterized by low and highly variable water availability through rains as well as scare ground water, generally sparse to scant vegetation, low fertility, low productivity of soils and highly erodable lands prone, to rapid degradation with intensification of usage. Besides these biophysical, features, the dry regions are generally deficient in other respects, such as poor infrastructure, high socio-economic marginality (poverty) etc., resulting from their past neglect by policy makers and planners due to their low potential pay off to investment and ability to generate surplus. Positive human response to constraints involve various forms of technological and social adaptations ranging from diversified farming practices to collective efforts reflected through seed and input sharing practices, provisions of common property resources, group action during drought period etc.

Yet, drylands offer limited and low productivity options with high degree of risk and vulnerability specially due to frequent droughts of different intensities. If appropriately managed the drylands can also offer some rich opportunities as the relatively better developed areas in the dry regions show. As mentioned earlier, the dryland communities responded to such a constraining production environment by

Table 1. Dominant biophysical features of natural resource base (NRB) and community adaptation measures in drylands[a]

A. Features of NRB	B. Traditional situation	C. Present day situation
Water/moisture scarcity and instability, frequent droughts and scarcities	Water harvesting, moisture conservation (bunding, etc.), limited ground water harnessing, focus on crops (mixed crops) with varying drought tolerance; seasonal migration during droughts, focus on annual-perennial plants complementarities	Moisture conservation/water harvesting measures requiring group action declined due to increased social differentiation. Rapid increase in ground water exploitation. *Reasons*: Drilling technology, govt. subsidies and high prices of irrigated crops, lost collective concerns of communities for local resources
High fragility, erodibility of land, not suited to high intensity uses	Overall land use and folk agronomic practices focused on combining production and conservation needs; focus on practices such as shallow tillage, terracing, bunding, strip farming crop-fallow rotations; more marginal lands allocated to animal grazing, common property resources (CPR)	Gradual discard of conservation-promoting land use systems; enhanced land use intensity, rapid degradation of land for both cropping and grazing *Reasons*: Population growth, backlash of R&D-based modern technologies on traditional ones; decline of collective stake in local resources and social controls replaced by public laws
Scarce and slow growing/ regenerating vegetation, frequent shortage of natural biomass supplies	Traditional agroforestry/farm forestry, periodical long fallows, regulated and collective efforts to maintain CPRs, provisions of protected areas e.g. water bodies, religious sites etc.; seasonal closure/rotational use of grazing space	Traditional farm practices and institutional provisions facilitating vegetation protection/growth discarded; new initiatives such as JFM, agroforestry with new components yet to pick up at large scale *Reasons*: Reduced collective concerns/efforts; increased dependency on government - subsidy progammes, socio-economic differentiation
Soils with low nutrient and low potential for biomass and crop productivity	Farming systems focused on crop-livestock complementarities, local organic inputs, periodical resting (fallowing) of crop lands, cereal-legume rotation or mixed cropping	Decline of sources and usage of practices/systems helping soil fertility; increasing use of chemical inputs. *Reasons*: Extension and subsidy of chemical inputs, formal R&D indifferent to traditional practices.

Table 1 contd....

Table 1 continued.....

A. Features of NRB	B. Traditional situation	C. present day situation
Overall high degree of marginality of NRB offering limited, high risk, low productivity earning options to communities	Accepting "inferior earning options"; stabilize and enhance opportunities using the practices mentioned above; collective risk sharing during crisis; external links through migration; petty trade; relief and charity.	Gradual discard of traditional approaches due to availability of new options through development intervention (including new technologies), rising dependence on public support, diversification of sources of livelihood including public relief, out-migration, earning through urban jobs, etc. *Reasons*: Emerging new phase of adaptation strategies.

a) Based on evidence/inference from Arnold and Dewees 1995, Bantilan *et al.* (2002), Dasgupta and Karl-Goran (1990), Gupta (1997), Jodha (2000, 2001, 1991a, 1991b, 1998, 1992, 1995), Jodha and Mascrenhas (1985), Jodha and Singh (1982), Kerr and Sanghi (1992), Shah (1993), Walker and Jodha (1985), Reddy *et al.* (1993).

evolving resource use practices and local institutional arrangements.

Table 1 summarizes these adaptation practices with reference to key elements of constraints. The essence of the measures and practices with their broad contexts could be summed up as indicative adaptation strategies of dryland communities.

1. Largely ecology-driven resource management, using traditional conservation and protection technologies and institutional arrangements evolved with closer feel of the resources and enforced through local autonomy and control of local resources; rationing of demand on resources (including seasonal migration), and restricting extraction levels in keeping with subsistence needs.

2. Technologies and usage practices combining intensive and extensive uses of land resources, provision of institutional arrangements (e.g., regulation of crop fallow rotation, common property resources) against over-exploitation of fragile/marginal lands, spatially and temporally differentiated resource use rationing, knowledge and capacity-based resource upgradation (e.g., by bunding, land shaping, trenching, water-harvesting, agroforestry, etc.).

3. Spatially and temporally diversified and interlinked activities with varying levels of land intensification; diversification of demand, matching with the diversity of products and supplies, especially in a semi-closed situation, external link through migration during drought, use of relief and charity.

4. A limited range of diversified activities directed to petty trading to supplement subsistence activities using local niche (such as specific oil seeds, herbs, livestock products, etc.), conditioned by demand and extraction facilities as key factors governing the exploitation of niche.

5. Ecology-driven and socially enforced systems of resource use conducive to sustainability (under the conditions of

low pressure of population and external demand, greater role of social concerns and decisions and lesser external interventions by market and the state).

6. Decisive role for community's collective stake and community's functional knowledge of resources as well as bridging the gap between resource user and decision maker.

Negative Shifts in Nature-society Links: Nature Pleads Not Guilty

The dryland communities' traditional adaptation strategies are gradually changing over time due to changes in circumstances that tend to reduce the efficacy and feasibility of traditional strategies. The change-inducing factors could be placed in the following two categories.

(i) Key driving forces, acting as basic contexts for change in adaptation measures.

(ii) Proximate or mediating causes, i.e., circumstances created by the key driving forces to which the changes in adaptation measures are directly related. The proximate changes are directly understood or are visible to resource users and induce them to change the adaptation measures. To illustrate the point, population growth as a key driving force leads to land scarcity as a proximate or mediating cause, forcing people to practice high intensity land use and discard practices like land fallowing that are, conducive to resource conservation. The consequent land degradation is attributed to intensification of the mediating cause. Hence approaches to address the resource degradation has to focus on both driving forces and mediating causes.

Some of these factors belonging to (i) and (ii) are already mentioned in a mixed way, while narrating the changes in people's responses to the features of drylands under Table 1 (col. 3). Some of these changes e.g., enhanced links of dryland systems with external systems, diversification of sources of livelihood, use of modern methods and technologies boosting productivity and income, etc., are helpful to the people. However, the concern here is to highlight the underlying resource exploitative processes or their side effects, which by marginalizing traditional practices tend to reduce the extent of positive ecosystem-social system links in the dry regions.

Based on the synthesis of changes in Table 1, I present an indicative picture of the involved shifts in ecosystem-social system links, covering basic objective circumstances and the driving forces they generate, the social responses they promote and their consequences, particularly in India (Table 2). It also indicates that, while traditional adaptations (despite lack of formal R&D and public investment flows) helped in promoting resource-protective/ regenerative social system-ecosystem links, the present day formal approaches due to their negative side effects tend to encourage degradation of drylands where nature pleads not guilty for the consequences.

Despite variations within the dry regions of the country, both at macro and micro-levels, the resource degradation process is widespread and visible in different forms and contexts. During the last 40 to 60

Table 2 Processes associated with the community approaches to natural resources in drylands under the traditional and the present day systems[a)]

Situation under the traditional systems	Situation under the present systems
A. Basic circumstances	
Fragility, marginality, and diversity of land resources leading to limited, low productivity, high risk options;	Enhanced physical, administrative and market integration of relatively isolated, marginal, areas/ communities with the dominant mainstream systems through state and market;
Low extent and undependable external linkages and support; subsistence oriented and small population;	Reduced critical dependence on local NRB; diversification of sources of sustenance;
Almost total or critical dependence on local, fragile, marginal, diverse NRB	Increased population and land scarcity.
Bottom line: High collective concern and action for health and productivity of NRB as a source of sustenance.	***Bottom line:*** Reduced collective concern for local NRB; rise of individual (extractive) strategies; gradual shift away from subsistence approach.
B. Key driving forces/factors generated by (A):	
Sustenance strategies almost totally focused on local resource;	External linkage-based diversification of sources of sustenance (welfare, relief, trade, etc.);
Sustenance-driven collective stake in protection and regeneration of NRB;	Disintegration of collective stake in NRB;
Close proximity and access-based functional knowledge/understanding of limitation and usability of NRB, promoting appropriate adaptations	Marginalization of traditional knowledge, and extension/imposition of generalized technological and other solutions from above;
Local control of local resources/decisions; little gap between decision makers and resource users.	Legal, administrative, fiscal measures displacing local controls/decisions; wider gap between higher levels decision makers and local resource users, adding elements of irrelevance and ineffectiveness to top-down interventions.
Bottom line: Collective stake in NRB, supported by local control and functional knowledge of NRB.	***Bottom line:*** Loss of collective stake and local control over NRB; resource users focus on own short term gains.
C. Social responses to (B)	
Evolution, adoption of resource use systems and folk technologies promoting diversification, resource protection, regeneration, recycling, etc.	Extension of externally evolved, generalized technological/institutional interventions, disregarding local concerns/experiences and traditional arrangements;
Resource use/demand rationing measures;	Emphasis on supply side issues ignoring management of demand pressure;
Formal/informal institutional mechanisms/group action to enforce the above.	Inappropriate intensification and resource degradation.
Bottom line: More effective social adaptation to NRB conditions.	***Bottom line:*** NR over-extracted and degraded.

Table 2 continued.....

Table 2 continued.....

Situation under the traditional systems	Situation under the present systems
D. Consequences	
Broadly nature-friendly management systems, evolved and enforced by local communities;	Over-extractive resource use systems, driven by uncontrolled demands;
Facilitated by close functional knowledge and community control over local resources and local affairs.	Externally conceived, ineffective and un-enforceable interventions for protection of NRB;
Petty trading based on niche products of drylands	Little investment and appropriate technology input in NRB.
	Under the process of globalization risk of selective over-exploitation of NRM and general neglect of other options.
Bottom line: Resource-protective/regenerative social system-ecosystem links	***Bottom line:*** Demand driven usage intensification, slackened collective concern and inappropriate use of technologies are promoting rapid degradation of fragile NRB; nature pleads not guilty.

[a] Table reformulated based on references given under Table 1.

years, when changes in drylands have been recorded by several investigators, some alarming trends have also emerged (Jodha, 2001). Despite visible success in some pockets, there are clearly visible, persistent negative changes, relating to a range of crops, yield as well as feasibility and cost of production of crops, availability of other agricultural products; the economic well-being of the rural poor, and the overall condition of environment and natural resources. Various forms of resource degradation including increased salinity (of both soil and ground water), deepening of water table, disappearance of a number of plant species from pastures and community forests and increase of areas under shifting sand are quite visible. Similarly, during the last couple of decades decline in overall biomass availability, substitution of cattle (and camels in arid areas) by sheep and goat, and the extension of cropping to sub-marginal areas to meet production deficits have been observed. Reduced productivity and reduced resilience of the traditional farming systems have led to increased dependence on public relief and increased seasonal migration to other favorable areas. Various facets of the decline have been recorded in different studies. However, the situation in the limited areas transformed through dependable irrigation systems is quite different. The negative changes mentioned above can be treated as indicators of unsustainability of present patterns of resource use in dry tropical regions.

Table 3 illustrates the emerging scenario, where the negative changes, relate to: (a) resource base (e.g. land degradation), (b) production flows (e.g. persistent decline in crop yields), and (c) resource management/ usage systems (e.g. increased unfeasibility of annual-perennial based intercropping, specific crop rotations, etc.). More importantly, for operational and analytical

purposes, the indicators can be grouped under following three categories on the basis of their actual or potential visibility.

(i) *Negative changes directly visible*: These include accentuated soil erosion, increased salinity of soil and ground water, increased severity of drought-induced scarcities, reduced feasibility and efficacy of traditional adaptations against weather risks, reduced overall biomass availability and reduced carrying capacity of pastures.

(ii) *Negative changes made invisible*: People's adjustment to negative changes often tends to hide the latter. In dry tropical areas such changes can include: substitution of shallow-rooted crops by deep-rooted crops following the loss of top soil, due to erosion, substitution of cattle for small ruminants due to permanent degradation or reduced carrying capacity of grazing lands, introduction of public food distribution system due to the increasing inter-seasonal hunger gaps (local food production deficits), small farmers leasing out their lands to concentrate on wage earning, and shift towards increased external input in cropping due to the decline of locally renewable resources/inputs.

(iii) *Development interventions with potentially negative consequences*: A number of measures are adopted to meet current or future shortages of products at current or increased levels of demand. Some of the measures, while enhancing productivity of system in the short run, might jeopardize ability of the system to meet the increasing demands in the long run directly or through their side effects. Experience of some areas under green revolution shows this. Chances of such happenings are linked with the interventions' insensitivity to or inadequate understanding of specific conditions of the fragile areas (Altieri, 1987; Jodha, 1986b). Over-irrigation in Indira Gandhi Canal areas in Rajasthan, and failure of intensive cotton farming using costly chemicals that led to suicide by farmers, illustrate this.

Future Prospects

Based on the past changes and emerging trends it is clear that ecosystem-social system links change with the changing scenario in the form of driving forces or proximate causes. Some of these are direct or indirect products of the nature-society interactions in the preceding phases, while others could be independent of the same. Hence, while reflecting on the future scenario of drylands, it will help to identify the context or emerging critical driving forces inducing the changes in nature – society interactions in drylands, their implication and possible responses. An indicative list of driving forces follows.

- Rising human and animal population (pressure on land)
- Increased socio-economic differentiation (shrinking prospects for collection/group action)
- Drylands' closer integration with mainstream situation through infrastructure, trade, technology, administrative set up, etc.
- Enhanced technological space and capacity (further neglect of traditional practices)
- Current degraded status of drylands (limited incentives for change)

Table 3. Negative changes as indicators of the unsustainability of current resource use systems (including agriculture)[1]

Visibility of change	Changes related to[a]		
	Resource base	Production flows	Resource use/ management practice
Directly visible changes	Various forms of resource degradation: emergence of soil salinity; burial of fertile soil by shifting sand, loss top soils due to water/wind erosion; deepening of water tables, reduced perennials, increased inferior annuals and thorny bushes; reduced per capita availability of productive resources.	Reduced total and per capita biomass availability; reduced average crop productivity, increased cropping on sub-marginal lands; reduced produce for recycling; higher dependence on inferior options, (e.g. harvesting/ lopping premature trees), increasing severity of successive drought-impacts; increased dependence on public relief, increased migration.	Changes in land use pattern, cropping on sub-marginal lands; decline of common property resources; reduced diversity of agriculture (e.g. number of crops/enterprise and their inter-linkages); reduced feasibility and effectiveness of traditional adaptation strategies (e.g. rotation, intercropping, biomass based strategies)
Changes concealed by responses to negative changes[b]	Substitution of cattle, camels, by small ruminants; increased emphasis on mechanization of cultivation and water lifting; reduced idling of land; large scale 'reclamation' (!) of waste lands; shift from local to external inputs (e.g. from manure to chemical ferti-lisers, wooden tyre to rubber tyres for bullock carts).	Higher coverage by public distribution system (food, inputs) and other anti-poverty programs; reduced reliance on self provisioning system and greater dependence on external market sources; changes in land use pattern favouring grain production, and mono-cropping.	Discarding of minor crops, shift towards monocropping with standardization of inputs/practices; increased land use intensity; shift from two-oxen to one-ox plough; tractorisation; practices; replacement of self-help systems by public support systems.
Development initiative and potentially negative changes[c]	R&D focus on crop rather than resource; technique rather than user-perspective (e.g. method/species/inputs rather than group action for watershed/range development); resource upgrading ignoring its limitations (e.g. irrigation in impeded drainage areas); inducing high use	Highly subsidized, narrowly focused production programmes; focus on crops ignoring other land based activities, grain yield ignoring biomass; mono-cropping ignoring diversification; relief operations focused on people and livestock ignoring resource base,	Sectoral focus of R&D and other support systems ignoring flexi-bility and diversification needs; privatization of common property resources; extension of generalized external approaches to specific areas; disregard of folk

Table 3. contd.....

Table 3. contd.....

Visibility of change	Changes related to[a]		
	Resource base	Production flows	Resource use/ management practice
	intensity of erodable soils, and other resource extractive measures (e.g. tractorization).	thus promoting high pressure on poor and progressively degrading resource base.	knowledge in formal interventions; replacing local informal arrangements by rigid legal/ administrative measures.

[1] Table based on evidence extracted from references given under Table 1 plus other gray literature and field observations.

[a] Most of the changes are interrelated and they could fit in more than one block.

[b] Since a number of changes could be for reasons other than unsustainability, a better understanding of the underlying circumstances of a change will be necessary.

[c] Changes under this category differ from the ones under the above two categories, in the sense that they are yet to take place, and their potential emergence could be understood by examining the involved resource use practices in relation to specific area-resource characteristics.

- Rising role of market including economic globalization (new risks and opportunities)
- Emerging greater concern for drylands (harnessing the new opportunities)
- External macro-level factors including globalization, global environmental change, climate change, etc., affecting biophysical and social variables at micro-level.

The potential or actual contribution of the above factors to resource degradation through different processes, possible responses to reduce their impacts and finally the agencies responsible to promote and implement these response measures are summarized in Table 4 and discussed below.

Diversification

The most important area of adaptation-responses to arrest or reverse the resource degradation trends in drylands is focus on diversification at different levels and in different contexts. These are:

(a) Diversification of land use with special focus on non-crop use of land that will help reduce land use intensification.

(b) Diversification of cropping in new context of commercialization of agriculture, combining high value cash crops and largely subsistence crops to make dryland farming high income generating and sustainable.

(c) Diversification of occupational structure, including focus on post-harvest activities (processing, marketing), enhanced rural-urban links, development of infrastructure and non-farm activities and enterprises. This will not only help in reducing direct pressure on land, but will also provide higher income through closer interactions between rural and urban areas.

Stakeholder Participation and Group Action

Sustainable resource management in drylands requires as much involvement/ commitment of resource users as that of

Table 4. Key driving forces to be addressed for evolving future adaptations in drylands[1]

I. Rising population
- (a) Contribution to resource degradation process
  - Create land scarcity
  - promote land use intensity
  - reduce conservation-promoting diversification/extensive landuse
- (b) Potential responses
  - Pressure reduction on land by effective population control measures
  - off-farm activities
  - agro-processing, value adding activities
  - diversified high value land use options
  - expansion of infrastructure facilities and equitable rural-urban links
  - productive migration
  - livestock management with focus on quality/productivity not number of animals
  - market oriented product-processing
- (c) Role, responsibility and support issues
  - State, communities, NGOs, technologies and management specialists

II. Increased socio-economic differentiation: rebuilding collective stake in local resources
- (a) Contributions to resource degradation
  - Decline in culture of group action
  - social indifference to community resources and management practices
  - decline of collective risk sharing, natural asset building and group-based agricultural practices
- (b) Potential responses
  - Build upon the successful experiences of participatory group action initiatives
  - promotion of resource-specific grouping of stakeholders
  - bottom-up, local level group initiatives and their up-scaling
- (c) Role, responsibility and support issues
  - Provision of policy-programme support and incentives
  - NGOs and community mobilizers
  - focus on demonstrating gains of group actions
  - promotion of such grouping as a part of mandatory activities at different levels for NR management

III Closer integration of dryland economy in to mainstream economy: How to protect against negative side-effects
- (a) Contributions to resource degradation process
  - general paradigm, making resource use systems demand-driven rather than supply-driven
  - state, market forces insensitive to specific vulnerabilities of drylands,
  - extension of generalized intervention to dry areas
- (b) Potential responses
  - Mandatory provisions for assessing capacities/limitation of resources before initiating development interventions;

Table 4. contd.....

Table 4. contd.....

- higher priority to resource upgrading, conservation while designing measures
- focus on harnessing niche opportunities/resources
- interventions to match the internal diversities of landscapes
- ensure equity of dryland's links/interactions with mainstream system

(c) Role, responsibility and support issues

- Most responses suggested fall in policy-program area, hence greater responsibility of state
- involvement of local communities in identifying and implementing interventions
- restriction on free play of market forces.

IV Enhanced technological space and capacity: Focus on need and relevance

(a) Contributions to resource degradation process

- Negative side effects on health and productivity of resource
- successful in selected pockets, pushed to larger unsuitable areas
- technologies enhancing farmers' capacity to over-exploit resources (e.g. ground water)
- dominance of crop-centred rather than resource-centred technologies
- disregard of traditional technologies

(b) Potential responses

- Options with closer understanding of diversified landscapes
- controlled location specific trial before extension
- development involving formal R&D and elements of traditional technology
- technologies that help in product processing/value addition
- making dryland products competitive

(c) Role, responsibility and support issues

- R&D agencies
- research planners and supporters
- NGOs and community organization for projecting worth of traditional technologies/products
- policy and incentive environments

V. Current status and rehabilitation possibilities

(a) Contributions to further degradation

- No incentive for resource users to improve heavily depleted resources
- mutual reinforcing of natural resource vulnerabilities and social vulnerabilities
- a vicious cycle of degradation promoting degradation
- lack of investment resources and group initiatives

(b) Potential responses

- Incentive and simple technological options for resource users
- promotion of collective action for rehabilitation
- leasing of degraded lands to specialized conservation agencies
- specific conservation technologies

Table 4 contd.....

Table 4. contd.....

- learning from experience of successful initiatives in the past (e.g. JFM, watershed development projects

(c) Role, responsibility role and support issues

- R&D establishments, government, NGOs and farmer groups
- development agencies and investors
- specific development agencies such as wasteland development authority

VI. Economic globalisation: adapting to potential risks and opportunities

(a) Contributions to resource degradation

- Globalization led potential risk of further marginalization and neglect
- unregulated market forces – favor profit earning, competitive activities products, services while most drylands generally lack the same;
- missing support systems/structures/capacities to respond to globalization
- globalization-led processes favor resource intensification, discourage diversification

(b) Potential responses

- Reorientation of resource use goals, focus on unique, high value products, services with commercial angle
- identification and promotion of niche resources, products, services having advantage
- focus on product processing, better infrastructure and equitable market links
- local skills and capacity building for new tasks

(c) Role, responsibility and support issues

- R&D for identification and promotion of niche products, and services
- institutional support for building capacities/organizations
- private sector – through collaborations with farming communities
- Government for promoting farmers federations by the government to be able to compete

VII. Enhanced concern for drylands: harness the opportunities[1]

(a) New opportunities

- Enhanced awareness of poor status of natural resources and poverty
- new scientific/technological possibilities
- rising voices of civil society and farming communities
- NGO, academics projecting value and worth of indigenous systems
- better space to drylands in policy programs, create new opportunities
- sustainability-focused research/extension by R&D institutions

(b) How to harness the opportunities

- Build a committed and informed lobby of people for effective policy, program dialogue and advocacy of drylands
- mobilize problem-specific, area-specific resources support
- combine bottom up approach with top down approaches
- involve interventions with focus on diversity
- up-scaling the successes of past initiative to larger areas

Table 4 contd.....

Table 4. contd.....

(c)	• Role, responsibility and support issues • Major reorientations in policies and program • greater role and responsibilities for governments, development planner and field agencies • advocacy groups

[1] Based on Bantilan *et al.* (2004), Biot *et al.* (1995), Chopra *et al.* (1998), Gupta (1997), Hazra and Kaul (1996), Joshi *et al.* (2004), Jodha (1986, 1992, 1995, 1996, 1998, 2000, 2001), Kassas (2000), Kerr and Sanghi (1992), Mruthyunjaya *et al.* (2003), Shah (1993), Walker and Ryan (1990).

other agencies such as state and scientific experts. In several cases collective action is a must. However, in view of the socio-economic differentiation and increasing diversity of interests, traditional type of group action is not possible. Hence, collective action through user group initiatives should be promoted. This should be built on current initiatives promoted by NGOs and others. This will help to build local capacities and skills needed to run various activities to adjust to rapidly commercializing agriculture as well as risks and opportunities generated by globalization.

Technological Opportunities

(a) New science and technology has already penetrated the dryland agriculture. To make it more effective in making dryland usage sustainable scientific options to specificities of drylands (with due protection against their negative side effects) need to be focused.

(b) Integration of traditional technologies with modern R&D to make resource use, cropping systems, etc., jointly address need of production and conservation.

(c) Help in identification, promotion and harness of 'niche' opportunities (including high value products) and make dryland agriculture competitive in the globalizing era. This will help in harnessing the gains of closer integration of dryland system with mainstream situation in the country.

(d) Science and technology will need to help in conservation of specific resources of drylands such as water, forest and range lands, which usually are common property resources.

(e) R&D should help in reviving the degraded natural resources.

Opportunities through Enhanced Concern

(a) The enhanced concern for drylands is visible in different policy-programs. Sustaining this concern is one challenge that has to be maintained through projecting their impacts. This may call for initiating an informed lobby projecting the problems and solutions of drylands.

(b) Involvement of NGOs and civil society to take up this task could be one option.

(c) Development of specific policy-program measures should be one outcome of the increased concern.

(d) Involvement of local agencies and community representatives should be a part of the bottom up action.

(e) Measures to protect dry areas against risks of economic globalization and climate change should have high priority.

(f) The enhanced concern for drylands is clearly effected through changed research priorities in R&D organizations. However, to sustain that adequate funding support should be ensured.

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