

Natural Resource Conservation, Use and Sustainability in Drylands

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This keynote address of the conference on Natural Resource Conservation Use and Sustainability in Drylands, focuses mainly on some new concepts of resource assessments in dry areas, some recent debates on organizational ideas on communities and their institutions; larger issues to place the importance of this work in perspective. Among other things it points out that the mixture of public and private initiatives in strategic organizations today is a question with experimental possibilities. The question of the organization of small farmers and their links with higher level organizations like input supplying or selling companies, or irrigation systems, is a complex one. The possibility of small farmers to form their own companies, without loss of control on their land, now exists under the law and needs to be explored. The Cooperative principle is alive and kicking, if we have the strength to adapt and innovate. The Producer's Company legislation now on the statute book provides an important method of strengthening farmer groups to take advantage of strategic alliances for growth, following the cooperative principle. It is being reported that the proposed amendments to the Company Act are planning to change the Producer Company provisions. It is important that the institution is strengthened.

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This is a conference of experts and experienced workers. I propose, therefore to very briefly reflect on some new ideas of old concerns. I am not sure if they are all of implementation value, but discussion in a group of this kind I am confident will help.

Resource Assessments with Satellite Imagery

The use of space technology is well known and Sharma et.al., Vaidyanathan and Dubey (2000), have listed all the possibilities comprehensively. A Seminar conducted by ISRO with the Indian Society of Agricultural Economics on Remote Sensing and Agricultural Statistics has shown the way ahead. A. Vaidyanathan, and Y.K. Alagh noted that strategies and programmes have been set from the last decade and a half and substantial progress is now possible if coordinated policies are followed.

The Vaidyanathan-Alagh proposals emphasized the relevance of National Natural Resources Management System (NNRMS). This included Crop Acreage and Production Estimation as a major project on generation of crop statistics using remote sensing data. Under the sponsorship of the Ministry of Agriculture (MOA), Government of India, the joint MOA-ISRO formulation of forecasting Agricultural Output using Space, Agro-meteorology and Land-based observations (FASAL) project aims at integration of land, space and weather data. A six-point programme for using satellite data to supplement traditional sources of agricultural statistics, included timely data on Land Use Statistics (LUS) where the traditional Crop and Season Reports were generally available with a time lag of three to five years. This is important in view of the acute land scarcity emerging from the constancy of net area sown. Second space data should be used for checking climates of errors of crop area and yield statistics. While at the national level Timely Reporting Scheme (TRS) and National Sample Survey Organisation (NSSO) sample checks gave low errors on production, at the state level, area and yield errors

could be between 6 per cent and 12 per cent. Space data would be another check and would give timely results. Third, geographic mapping systems should be used not only for public sector projects as earlier in watersheds, etc., but also for cooperative, NGO and private sector projects since around 40 per cent of foreign investment was in the agro-processing sector. The earlier drafts of the Space Policy enunciated provided marketing of space data by ISRO. It has been noted that the ISRO subsidiary Antrix was successful both at home and abroad. Fourth, two-way information systems would be developed with the help of space facilities. The farmer should not only be a source of data to the Patwari and for yield statistics, but should also be the recipient of technology and agro-economic data he needs for agriculture in a liberalizing economy. Finally, a small nucleus institute, centre with experts on deputation from ISRO, Central Statistical Organisation (CSO), NSSO, MOA, Indian Meteorological Department (IMD) to build up new systems of man and machine working together in a restructured agricultural information system, was necessary.

The relevance to agro-climatic planning to dryland areas is well known and as its granddaddy I will not repeat it. Taking the AESR classification as the basis, a new approach to agro-climatic planning has been suggested by the Parthasarathy Committee (PC) 2005. The mandate of the PC was to “assess and suitably modify the existing criteria for categorization of arid, semi-arid and dry sub-humid areas taking into account the changed climatic/biotic factors and identify the blocks for the implementation of DDP and DPAP”. A similar exercise was done earlier by Hanumantha Rao Committee (1994), which used moisture index at district level as the basis of classification. The PC has suggested a method by which crop production potential and the extent of drought vulnerability could be assessed at the block level using a composite drought index combining bio-climates, rainfall, irrigation and extent of vegetation. Drought is usually understood as a failure of rain. Hence, by the usual standards, the severity of the drought is measured by the extent of deviation of current year's rainfall from the long period average ("meteorological drought"). Since the quantum of rain varies between bio-climates, it is clear that we need to have different ranges to assess severity of meteorological drought in different bio-climates. The PC suggests the following ranges for calculating drought-proneness at the block level in their (Table 7).

Table 7: Weightage for Drought-Proneness in Bio-Climates

Type of drought	Weightage marks	Drought proneness (per cent departure of rainfall from mean)		
		Dry sub-humid (MI 0 to -33.3)	Semi-arid (MI-33.3 to -66.6)	Arid (< -66.6)
Normal	0	< - 24	< - 19	< -14
Mild	10	-25 to 37.4	- 20 to 35.0	-15 to -37.5
Moderate	20	-37.5 to 50.0	-35.1 to 50.0	-37.6 to 50.0
Severe	40	> 50.1	>50.1	> 50.1
Total	70			

Thus, a 15 per cent deviation from average rainfall in a year will not be considered a drought in sub-humid and semi-arid bio-climates whereas it would qualify as "mild

drought" in an arid bio-climate. Each category of meteorological drought is ascribed weights, which should be multiplied with the extent of the area suffering from rainfall deviation of the magnitude mentioned against it. Thus, we get a weighted drought index. Higher the value of the drought index, the more drought-prone the block will be.

Access to irrigation reduces drought vulnerability. Hence, the severity of the drought should be assessed together with the access to irrigation in a block. Moreover, sources of irrigation vary in their reliability and use efficiency. Hence, they are given different weights. Canal irrigation, which is considered most reliable, is given the least weightage. The PC gives maximum weight to a situation without irrigation ("rainfed"). Weightage factors given for different sources of irrigation are given below (Table 8).

Table 8: Weightage for Sources of Irrigation

Source of irrigation	Weightage marks
Canal	2
Lift	8
Rainfed	20
Total	30
Source: PC	

The percentage of irrigated/rainfed area of the total block is multiplied with the weightage factor to get weighted irrigation index. This index is calculated for all blocks. Higher the value of irrigation index, the more drought-prone the block will be. These two indices are then combined to get a composite drought index. The weights given to the two indices are not the same. (Table 9).

Table 9: Weightage of Drought and Irrigation Indices

Indices	Weightage marks
Weighted Drought Index	70
Weighted Irrigation Index	30

Based on these weightage factors the composite drought index is estimated.
 $Y = 0.70X1 + 0.30X2$

The higher the value of the composite drought index, the more drought-prone the block will be. Using this approach, drought vulnerability can be delineated at the block level and appropriate strategies could be visualised.

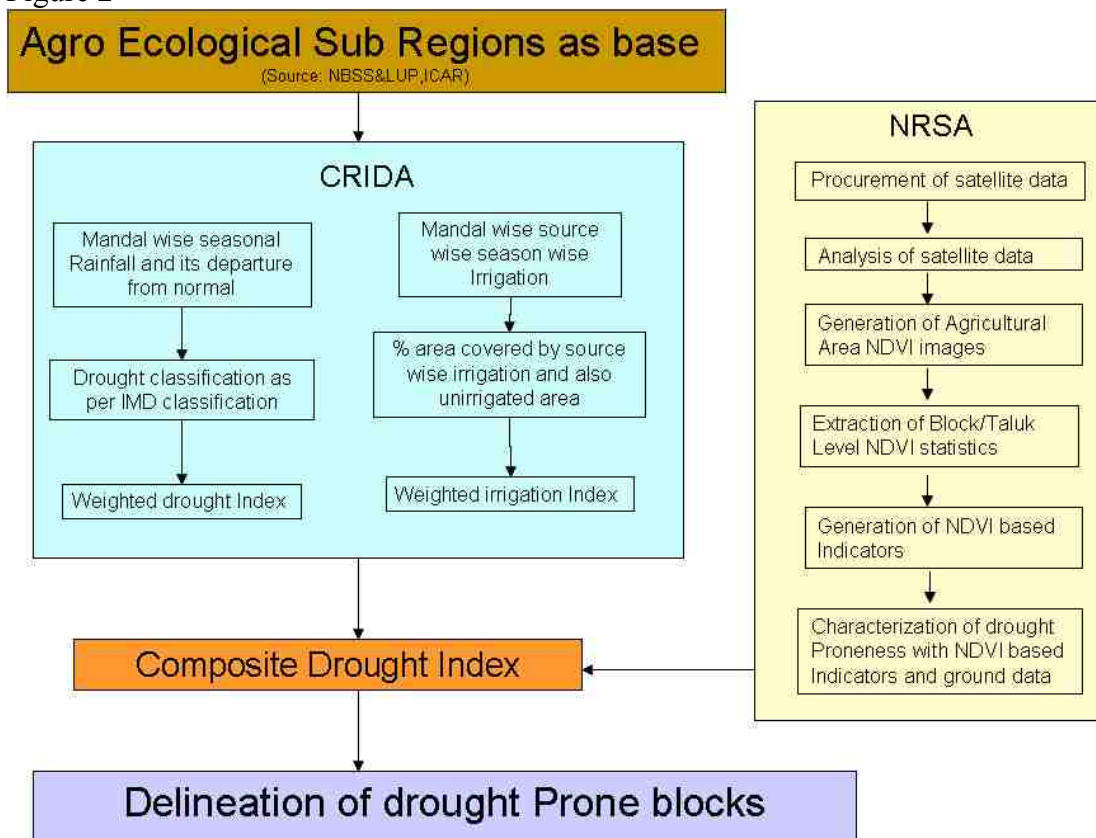
Is this an advance? I think it is. But we should discuss it. The one addition I would suggest is to include The number of waterings, which we used for SSP planning as an additional indicator (See Y.K.Alagh, et.al., 2006). This is important since irrigation can mean many things in dry areas and some are consistent with deprivation.

Mihir Shah and PC have recently suggested that generalising this approach by including other bio-climates and their respective weights and ranges for rainfall deviation and irrigated area, the AESR approach to agro-climatic planning could be considerably strengthened. This approach would enable us to identify highly vulnerable segments at a

block level within an AESR for which suitable land use packages need to be implemented to reduce drought vulnerability.

According to him a major weakness of the AESR approach is that it does not assess vegetative cover directly. The PC suggests a new method of utilising remote sensing data from NRSA to develop a Normalised Difference Vegetation Index (NDVI) for each block, to validate the composite drought index. National Agricultural Drought Assessment and Monitoring System (NADAMS) is a remote sensing based agricultural drought monitoring mechanism in India and providing near real-time information on the prevalence, severity level and persistence of agricultural drought at national/state/district level. The methodology of the PC is shown in the following figure (Figure 2)

Figure 2



Mihir Shah has pointed out that the data requirements for construction of the NDVI are huge. Interpretation of the data requires collective effort of a large number of institutions and scientific expertise. A more serious problem is that this method cannot deal with vegetational heterogeneity. This method runs into great problems when, as in India, several types of land uses co-exist and often mix with each other. While NDVI can broadly indicate the presence or absence of vegetation, the information it provides can be quite misleading unless it is coupled with a lot of ground checks. NDVI should, therefore, be correlated with other secondary information about the blocks as well as primary surveys to verify the extent of actual vegetative cover on the ground. Since this method tries to incorporate remote sensing information into drought monitoring and crop

planning, it should be made part of the existing models of agro-climatic regional planning in India.

I would suggest that these methods are at present treated as aids to planning and not for identifying arid regions. One danger is that dry regions doing well would tend to be penalized.

Communities and Institutions

For land development, access to water, technology and markets, under stress conditions three kinds of institutions are being talked about and experimented; namely, the private sector, stakeholder institutions like Cooperatives and Producer Associations, which can register under the Companies Act, 2002, Second Amendment Bill, which translated into law, a model I had developed for the reform of the Cooperative Sector and the Panchayats themselves. The first aspect to note is that it is early hours yet and we should go by experienced based studied results and I trust the Seminar would support the recommendation of Rapid Appraisals, Case Research and Evaluations to feed back into decision making through real time. I believe that enough is going on in the field to make this possible. We may discuss some of the possibilities.

When the original legislation on Panchayati Raj was being designed in the late Eighties, under the supervision of the present Minister of Panchayati raj, the idea that agencies that access technologies and markets to farmers or artisans would have a relationship with the Panchayat was discussed. A Think Tank, working under Secretary Planning Krishnamurthi saw stakeholder institutions as Sub-Committees of the Panchayat. This was very preliminary and in fact sounds rather naïve now. The Mid term Appraisal of the tenth Plan and the Approach paper of the Eleventh Plan sets the right tone and the PM has in his Independence Day address last year opted for the Authority For Rainfed Regions. Indira Gandhi started the quest for self reliance in foodgrains in 1975 from the Red Fort, Rajiv Gandhi was the forerunner of agro-climatic planning, the origin of the “second green revolution’ again in 1986 from there and so we must hope for the best. If the New Authority now set up is taken up in earnest the beginning of the battle is won. The Technical Committee on Watershed Programmes, 2006 or the S. Parthasarathi report, with inputs from activists like Mihir Shah (2006) has given the Blueprint, and these were also there in what is called the Bhopal Declaration, but there are many issues that remain to be addressed.

I believe that working models with stakeholder groups and PR agencies need much greater attention. Land scarcity is going to be perhaps the single greatest constraint to Indian development. Local bodies are the repositories of what are called Common Resources. Those who work or live off a resource are obviously the first to be affected and need to be consulted. We need to build models of cooperation rather than clash. These are not simple matters and while best practice cases exist, we do not as yet have working systems. The idea that land is not an economic good in the market which lies behind the tenancy legislation, is irrelevant in practice for the greatest change that has taken place in rural India is land being transferred voluntarily from very small peasants to middle peasants in what is called reverse tenancy. Private organizations are expanding in

ground water exploitation and there is the beginning in Gujarat of small water storage tanks in private plots. The economic interest in land and water has to be at the heart of any reform process. I believe that groups of stakeholders, including the smallest peasants can cooperate for well defined and limited purposes for land development and water projects. Farmer level irrigation management systems, watershed development projects, groundwater cooperatives are all thriving and many more and very promising possibilities are there.

The argument that each agro-climatic region has its own solutions is well known and so I wont repeat it. Suffice it to say that a Framework Plan with targets, best practice cases, policies and threats anticipated exists, sadly on paper [Alagh, 1989]. Its developments have been professionally reviewed [Chopra and Kadekodi, 2003]. We always complained, but now one of the more experienced hands has called the Nineties the “Golden Decade” for watershed development, JFM’s and Participatory Irrigation Management. Therefore:

When those working for Participatory management of natural resources were hoping for strengthening and carry forward participatory approach in 2000-2001 at the time of formulation of the Tenth Plan, there was severe setback as described in the paper “The Fading Shine of the Golden Decade.” The paper, annexed to this report, is a cry of anguish. When this paper was presented to Dr. MS Swaminathan and Prof. YK Alagh, they encouraged DSC to organize national level deliberations to voice concern at the dilution and almost reversal of the participatory approach and at the same time present Principles that should guide the formulation and modification of schemes of NRM by center, states, or donors [Anil Shah, Bhopal Declaration, 2005].

The Bhopal Declaration emerged because stakeholder participation was diluted both in watersheds and in JFMs; the former in the Hariyali Guidelines and the latter in departmental instructions. It consists of Eight Principles for revival and Road Maps for each.

These are;

Principle-1: Centrality of Community Based Organisations (CBOs)

Gram Sabha and as its executive committee the Gram Panchayat should be associated with stakeholders’ organizations so as to secure required support for the development of local resources. CBOs will represent interest group of primary stakeholders.

Principle – 2: Equity

At the design stage itself program must identify and account for losers and gainers or less gainers. Interventions in the form of differential contribution, customized village level institution building (e.g. gender segregated user-groups), non-negotiable budget provisions, gender-sensitive choice of technology and targeted delivery options are some of the approaches known to be more effective in reaching out to poorer sections.

Principle – 3: Decentralisation

Flexibility in technical, social and financial norms to suit varying local conditions should be facilitated through a decentralized process, by a broad based organization at the district level. The district level organization must be led by a CEO who is competitively selected for a fixed term on a performance contract basis and is granted full autonomy to deliver results within the limits of the organization's charter, a Governing Board with strong representation from stakeholders and, multi-disciplinary professionals with high competency that can provide support for effective decision-making.

Principle - 4: Importance of Facilitating Agency.

Principle – 5: Monitoring and Evaluation

These lessons have to be distilled from the field and made available to both policy makers and programme review body in a manner and time-span that it can be instrumental in improving programme policies and reforming or adopting improved procedures. When programmes are monitored in real-time and feedback is used for bringing reforms in the field, key functionaries are motivated to “embrace errors” and convert failures into learning opportunities.

Principle – 6: Training and Software Inputs

Principle – 7 : Sustained Momentum of Development

Initiate productivity enhancement and value addition during the project period and for a few years beyond so that NRM programmes realize full potential of local resources resulting into rising income and prosperity for the rural communities.

Principle 8: Organizational Restructuring

These organizations, at the national, regional, district, and local levels need to have much greater operating autonomy, and accountability for performance to their funders and for service delivery to the intended recipients.

NRM programmes require relatively highly autonomous organizations at district, state and national levels with performance accountability, accountability for service delivery to their stakeholders, and multi-disciplinary competencies, to enable them to design, modify, operationalise, and implement as appropriate the NRM programmes within their respective mandates. At the national level, this organization will take the form of a Board for each major programme. To facilitate excellent contribution to their respective missions, each of them must have a charter that clearly spells out its mandate, mission, powers, responsibilities, etc., a CEO who is competitively selected for a fixed term on a performance contract basis and is granted full autonomy to deliver results within the limits of the organization's charter, a governance board with strong representation from stakeholders and relevant professionals; an annual MoU between the organization and its controlling/funding authority that sets out performance and support expectations on both sides; a management information system (MIS) that provides periodic information on the organization's performance against its MoU commitments to its controlling authority and its stakeholders; a stakeholders' charter that sets out what services the stakeholders can expect from the organization and the mechanism for redressing any grievances they may

have; transparent HRM policies; performance-linked rewards; and 'best value for money' market tests.

The relevance of all of this to a group of rural development specialists is obvious. I will only highlight two Principles for you for this is a converted and highly motivated group which should not be harangued. The first is let us forget about the past. The second is that the seventh principle since it is new. Watershed Plus says that CBO's have to take the community to the market to take advantage of value addition and prices. This is an addition to the concept box and not easy. It took me quite some time to convince my friend Harnath Jagawat for example that his adivasi girls and boys will have to sell produce for profit, after successfully running lift irrigation cooperatives. For a land and water developer this is a new ball park and needs an effort. Cooperators will see this aspect immediately.

Are there Alternatives to CBOs, Coops and Producer Associations ?

The only alternative model that I know of and may be seriously suggested is Tushaar Shah's plea that the Chinese experiments in private sector institutions at the village level to run water systems should be the preferred model. Incidentally his model also includes a strong system upstream say upto the distributory as we would call it. Also I think he is underestimating the role of the Communist party in directing public-private partnerships in China. My impression after field visits in regions similar to the ones he worked leading a Rajiv Gandhi Foundation delegation in October 2004, is that the local agents are carefully selected and are responsible to higher authorities. It is not an accident that The Mayors of Shanghai go to Beijing at the highest levels.

My view is it is early hours yet and the mixtures of public and private initiatives in strategic organizations is an issue with experimental possibilities. The question of the organization of small farmers and their links with higher level organizations like input supplying or selling companies, or irrigation systems, is a complex one. The possibility of small farmers to form their own companies, without loss of control on their land, now exists under the law and needs to be explored. Later on, they may be allowed to have joint ventures with big companies, if they so decide. A problem visualized in contract farming is the organization of farmer groups to interact with large companies. One answer is to encourage farmers groups in this context. According to a recent review of such issues by Samar Dutta.:

Even though several states have introduced parallel cooperative laws, and even though the union law, too, has been made more liberal, yet the pace of reform has been far too slow. Several states have resisted all effort at reform. Farmers in Gujarat, Maharashtra, Tamil Nadu, West Bengal, Punjab, and several other states continue to have few options. Under these circumstances, a new chapter on producer companies was introduced in 2002, to the Companies Act. This legislation was based on a draft produced by a Committee under the Chairmanship of Y.K. Alagh (2000). The attempt was to draft the chapter to enable farmers and other primary producers to set up companies that resembled cooperatives as closely as possible. Where profits in companies is normally shared on the basis of share holding, producer companies can distribute profits based on patronage of services. Where other companies with several shareholders have to list their shares in the stock market, producer companies do

not. Voting rights in producer companies where individuals are members, is on the basis of one member, one vote. However, where institutions are members, voting right is based on patronage of business transacted with the federation. While it is possible for a producer company to wind up its affairs, the registrar of Companies has the right to “strike off” the name of the company, if he/she does not believe it to be based on mutual assistance among members [Datta, 2003].

The Producer’s Company legislation now on the statute book provides an important method of strengthening farmer groups to take advantage of strategic alliances for growth, following the cooperative principle. The Cooperative principle is alive and kicking, if we have the strength to adapt and innovate. It is being reported that the proposed amendments to the Company Act are planning to change the Producer Company provisions. It is important that the institution is strengthened, since it could provide the sinews to the National Authority for Rainfed Regions.

It is early hours yet and the mixtures of public and private initiatives in strategic organizations is a question with experimental possibilities. In the forthcoming period, I suspect farmers groups, stakeholder organizations and cooperatives, apart from playing a larger role themselves, will also play a larger role in strategic partnerships with business groups. Otherwise interaction between atomistic peasants and large companies may create problematic situations. A monopolist is not a villain of a Hindi movie. He just works with an inelastic demand curve. However the more we encourage organizations of smaller producers to organize their interests and strategize their relations with large companies, the better and more enduring will be the systems we will create. I believe Panchayats and bodies of stakeholder led institutions in the agricultural and related fields will play an increasing role in the emerging period. The one role where this will I believe be most important will be access to land. Relocation from land will be the most vexed question in India, in the years and decades to come. The more we build up transparent institutions at the local level in the details of solutions to these questions, the better off we will be. Inheriting the “Revenue” tradition Panchayats are the obvious candidates to underpin a sensible National Rehabilitation Policy, once we get it going. The EGS is also away of empowering the Poor to participate.

A good idea is to develop a matrix form of organization in which the role of the panchayat, the stakeholder organisation and the facilitating agency is stated in clear terms. I have brought with me the details of such an effort and can present it later for discussion.

Land and Water

Land

In 2002/03, the last year for which we have a number, the Net Sown Area in India was 132.86 million hectares (Table1). In a book authored with Uma Lele of the World Bank,(Table 3) I had predicted wrongly that net area sown would be stuck at 141 million hectares and growth needs would need to be sourced from productivity and more intensive cropping. Growth in net area sown at around 1 per cent annual in the early period of planning fell to around 0.6 per cent and then to 0.3 per cent in subsequent decades and was now not growing at all. It was reasonable to assume that the

geographical area of the country or the extensive land frontier for exploitation had reached its limits and some of us while at the Planning Commission had correctly projected that the net area sown or arable land of the country would remain constant. But now for the first time in Indian economic history we are told that net area sown, rising slowly earlier and constant since the early nineties has gone down by eight million hectares. The last year in which NAS was less than the 2002/03 number was in 1958/59.

Table1		
Net Area Sown in India 1999-2002		
(also years after 1960/61 with NAS below 135 million hectares)		
S.No.	Year	NAS (million hectares)
1.	1987/88	134.09
2.	1991/92	141.63
3.	1999/00	141.10
4.	2000/01	141.08
5.	2001/02	141.40
6.	2002/03	132.86

Source: Government of India, Ministry of Agriculture, Nov.2005, *Agricultural Statistics at A Glance:2005*, Table 14.2, p.176.

It would be imprudent to brush aside the decline in cropped area as a consequence of the drought of 02/03. It is true that in the South West Monsoon, 2002, 21 meteorological subdivisions out of 36 had deficient/scanty rainfall. In the earlier drought in the late Eighties, NAS also fell and the severity of the drought in 1986/87 and 1987/88 was comparable. But in the Eighties even in the second year of drought NAS was 134 million hectares and it was 139.58 million hectares in 1986/87. More basic factors seem to be now at play. We need to disentangle the 'drought' effect from these more basic factors leading to diversion of land from agriculture and this needs analysis with statistical and GIS data and field level verification, but at a more general level soil degradation, urbanization and slow down of irrigation have been suggested as reasons.

Soil degradation [See Ratna Reddy's work reported in Chaddha, 2005] has been extensively studied. It is now being suggested that urbanization is proceeding much faster than earlier estimates of scholars like A.Kundu, who worked with the low urbanization growth rates of the Census 1991/2001 period. For example for Gujarat, Yoginder.K.alagh and P.H.Thakkar worked out that a number of habitations which met the Census 2001 criteria of urbanization were still classified as 'villages'. According to

Population Census-2001, Census Towns are non-statutory towns and are actually rural areas, but satisfy the following criteria:

- (A) Minimum population of 5,000
- (B) Density of population of at least 400 persons per sq. km.
- (C) 75 per cent of the male working population engaged in non-agricultural activity.

It was found that in the decade 1991-2001, in Gujarat, rural non agriculture main workers increased more than urban non-agriculture main workers. As per the 2001 Population Census, there were 122 big villages in Gujarat, each of them satisfying the three Census criteria of non statutory towns. These villages had a total population of 11.21 lakhs. If this is taken as a correction factor, then the revised estimate of degree of urbanization of Gujarat for the period 1991-2001 will be nearly 39.57 per cent (earlier estimate being 37.36 per cent and the correction factor being 2.21 per cent).

Table2				
Level and Growth of Urbanization in Gujarat				
Year	Number of Towns	Population (in Million)		Urbanization (in per cent)
		Entire State	Urban Areas	
1	2	3	4	5
1961	181	20.63	5.32	25.77
1971	216	26.70	7.50	28.08
1981	255	34.09	10.60	31.10
1991	264	41.30	14.25	34.49
2001	242	50.67	18.93	37.36

2001 Revd	364	39.46	30.14	39.57
Source: Yoginder.K.Alagh and P.H.Thakkar, <i>Short Notes on Urbanization Levels</i> , Ahmedabad, SPIESR, 2006				

The level of urbanization in Gujarat has therefore not increased by 2.87 per cent points, but 5.06 per cent points, which is close to double the earlier estimated change and makes a big difference in policy and forecasting work, since it is well known that urban projections are based on urban-rural growth differences and changes in first differences of the magnitudes considered can make big impacts on outcomes. Earlier land use studies found little effect of urbanization on land use. For example decadal release of land for urbanization was generally less than 5 per cent. This may now change.

Water

There is an intimate relationship between cropping intensity, land use and water development. Irrigation permits the possibility of multiple cropping by bringing additional land under cultivation and the same land to be used more than once. Application of new technologies in the past was related to assured water supply. The new

technology obviously raises productivity. But on account of photo insensitivity properties, newer technologies permit shorter duration crops, which also is associated with increase in cropping intensity. The use of these kinds of relationships has been common in Indian agricultural policy and plan models, since the mid-1970s when the first agricultural sub-model of Indian planning was formulated for grain self reliance and is used in the current generation of water forecasting models also. (Chopra, 2005)

In the 1990s arable area had stopped growing and so the land constraint was far more severe. Growth was seen as now to be sourced from double cropping and yields. This fundamental relationship was used to project the intensive resource base of the economy. Table 3 shows that it was projected that by the end of the decade India would have used up most of its balance water reserves, with the irrigated area reaching around 114 million hectares by 2010. Projections for 2020 were a requirement of irrigation of 122 million hectares. The projections assume a vastly improved performance on the land and water management frontiers. It needs to be remembered that the balance ground water reserves are now more limited. A very dramatic effort will be needed to harvest and carefully use the available water.

Meanwhile in actual fact in this decade irrigated area stopped growing. (Table 4)

Table 4: Irrigated Area in India 1998/99-2002/03(mn.hec.)				
S.No	Year	Net Irrigated Area	Gross Irrigated Area	Irrigation Intensity
0	1	2	3	4
1.	98/99	56.51	77.64	121.13
2.	99/00	56.76	77.99	121.23
3.	00/01	54.83	74.29	119.46
4.	01/02	55.88	77.00	121.12
5.	02/03	53.07	70.67	117.60

Source: Government of India, Ministry of Agriculture, Nov.2005, *Agricultural Statistics at A Glance:2005*, Table 14.2, p.176.

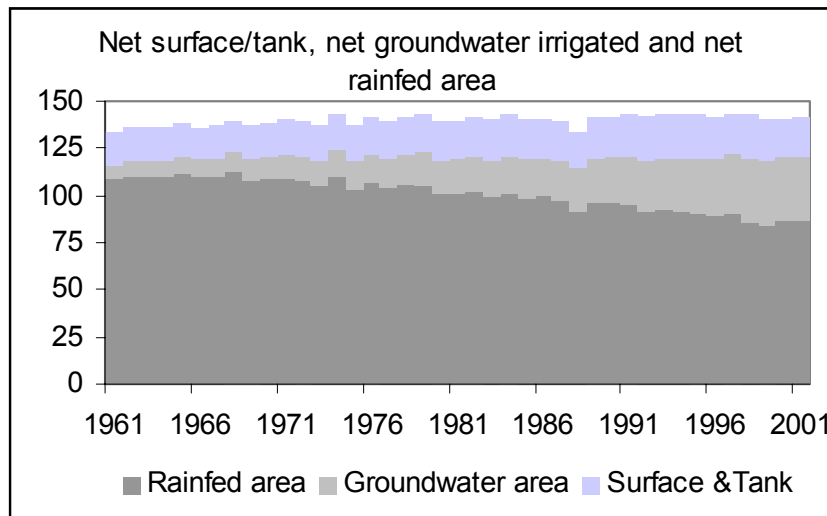
Table 5: Perspectives on Land and Water

Variable	1991/2	1996/7	2001/2	2006/7
Population (millions)				
a. Planning Commission•	856	938	1016∅	1099
b. UN (Unrevised)	874∅	955	1042	1130∅
Net Area Sown (mn. hec.)				
a. Planning Commission estimate	140	141	141	141
b. Revised		141	141	141
Gross area sown (mn. hec.)				
a. Planning Commission estimate	182	191	197	203
b. Revised	183	191	197	205
Gross Irrigated Area (mn. hec.)				
a. Planning Commission estimate	76	89	102	114
b. Revised	64	78	92	107
Cropping Intensity				
a. Planning Commission estimate	1.30	1.35	1.40	1.44
b. Revised	1.30	1.35	1.40	1.45
Gross Irrigated Area as per cent of Gross Area Sown				
a. Planning Commission estimate	41.5	46.9	51.7	56.1
b. Revised	35.0	41	46	51

Source: Uma Lele, Y.K. Alagh, et.al., *Forestry in India: An Evaluation*, Washington, World Bank, 2000, Annex H.

People like me were wrong in forecasting that cropped area would remain constant, but are right in the warning we gave. The decline in canal irrigated area is equally recent and

shocking, having been discovered by Tushar Shah of the International Water Management Institute in this neat little picture copied from the IWMI website.



We really do not have a detailed analysis of the debacle in irrigation. The first issue is the failure of the Advanced Irrigation Benefit Programme. This programme for completing on going irrigation projects was started when I was Planning Minister .It was started because we have a long history of successes with such programmes. The first such programme was started in 1975/76, when we had formulated a plan for food self reliance. Table 5 shows that it worked and irrigated area went up by 5 million hectares and irrigation intensity from 108.77 to 110.25. We then reinvented it in 1987/88 when the late Rajiv Gandhi wanted a Plan for stepping up stagnating agricultural production. As member in the Planning Commission, I saw it again worked and over a brief period irrigated area went up by around 5 million hectares and irrigation intensity from 113.15 to 115.15. There has been very little progress since. These earlier programmes and the critical role they played have been described elsewhere⁷, but the real issue is why did the AIBP fail? (See Table 4).We need a serious professional evaluation, but being involved with planning and monitoring such programmes for over three decades, I suspect that not including a Canal component to cover the last mile of water deliveries is one reason and the other is bringing in a loan component and not keeping it a Central Plan scheme.

Table 5: Impact of Special Irrigation Programmes in the Seventies and Eighties

S.No	Year	Net Irrigated Area	Gross Irrigated Area	Irrigation Intensity
0	1	2	3	4
1	74/75	33.71	41.74	108.03
2	75/76	34.59	43.36	108.77
3.	76/77	35.15	43.55	108.40
4.	77/78	36.55	46.08	109.53
5.	78/79	38.06	48.31	110.25
6.	87/88	42.89	56.04	113.15
7.	88/89	46.15	61.13	114.98
8.	89/90	46.70	61.85	115.15

Source: Government of India, Ministry of Agriculture, Nov.2005, *Agricultural Statistics at A Glance:2005*, Table 14.2, p.176.

There are, however more basic factors at play. As compared to relief against rainfall failure, the farmer now wants yield enhancing water supplies for water stress periods of diverse crops grown with modern technology. Access to ground water gives them this facility, badly planned and inefficiently managed canals don't. Farmers and their communities now want control on water deliveries. We have just started canal systems which employ for example hydraulic controls upto distributory levels and the successful examples are few and far between. In a recent critique of the Ken Betwa project put on web by the Interlinking of Rivers Project we have described how the soil scientists have shown that the area is unsuitable for paddy and irrigation would enhance yields from oilseeds, pulses and fodder crops, but the system is designed largely for flood irrigated paddy. We have also described the alternatives now possible, like the computer controlled delivery systems being constructed in the Sardar Sarovar Command. [See Alagh, 2006, below].

The implications of these trends are not being realized with the urgency they deserve, since at a basic level resource constraints of a more severe kind faced by certain East Asian economies are now being approached in India. Organizations, communities, households and individuals will have to grasp this fact and live with it. The severity of the blow will take time to sink in. But time India does not have. A few years ago I had warned that we are getting close to the kind of land and water shortage East Asian societies like China, Japan and Korea have grappled with, but have built up institutions through the centuries to cope. I had argued that we need to hasten. We would we hoped harvest water and improve irrigation deliveries.

The issues you are discussing are of the highest importance to India. It is also important that our deliberations inform public debate. At the least I hope we will release the ground water modelling done in SSP for the Kutch Branch for public consumption. Also the discussion on resource assessment shows the need to set up adequate machinery in Kutch for resource assessment. We must assure the people of Kutch that the waters allocated for

them in SSP will be available even after the full development of the project and that they will be assisted in using them well.

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