Sequía ЗАСУХА 干旱 Sécheresse

Drought Network News

October 1998 | A Newsletter of the International Drought Information Center and the National Drought Mitigation Center | Volume 10 No. 3

From the Director

On July 16, 1998, President Clinton signed the National Drought Policy Act into law. This law creates the National Drought Policy Commission (NDPC), which will examine current laws and programs and make recommendations to the president and Congress on the needs for a national drought policy. The Farm Service Agency of the U.S. Department of Agriculture will serve as the chair for the Commission, which will comprise 16 members. In addition to the Secretary of Agriculture, other members of the Commission will include the Secretary of the Interior, Secretary of the Army, Secretary of Commerce, Director of the Federal Emergency Management Agency, Administrator of the Small Business Administration, two governors nominated by the National Governors' Association, and two persons nominated by the National Association of Counties and the United States Conference of Mayors. The Commission will also include six persons (nominated by the Secretary of Agriculture, in coordination with the Secretary of the Interior and Secretary of the Army) representing groups acutely affected by drought emergencies, such as the agricultural production community, the credit community, rural and urban water associations, Native Americans, and fishing and environmental interests. Numerous groups are currently requesting representation on the Commission.

The NDPC will undertake several specific tasks during its 18-month duration. First, it will determine what needs exist on all levels of government to prepare for and respond to drought emergencies. Second, the Commission will review existing federal laws and programs relating to drought. Third, the Commission will review state, local, and tribal laws and programs relating to drought. Fourth, the Commission will determine what differences exist between the needs of those affected by drought and the federal laws and programs designed to mitigate the impacts of and respond to drought. Fifth, the Commission will collaborate with appropriate entities to consider appropriate regional initiatives and the application of such initiatives at the national level. Sixth, the Commission will make recommendations on how federal drought laws and programs can be better integrated with ongoing state, local, and tribal programs into a comprehensive national drought policy that emphasizes improved mitigation and response to drought emergencies. Seventh, the Commission will make recommendations on improving public awareness of the need for drought mitigation, prevention,

Published in cooperation with the World Climate Program of the WMO

and response and on developing a coordinated approach to drought mitigation, prevention, and response by governmental and nongovernmental entities. Finally, the Commission will include a recommendation on whether all federal drought preparation and response programs should be consolidated under one existing federal agency and, if so, identify that agency.

The movement to form a comprehensive national drought policy has been a long time in coming. In fact, the United States has had a drought policy for some time, albeit an ad hoc approach that emphasized crisis management and often rewarded individuals and entities for not preparing for the recurrence of drought. Recommendations to form a national drought plan date back at least to 1979, when the General Accounting Office recommended that such a plan be formed to provide assistance in a more "timely, consistent, and equitable manner." This recommendation was largely ignored by federal agencies. In addition to my own personal recommendations to create a national drought policy and plan, other scientists subsequently made similar proposals. In addition, entities such as the National Academy of Sciences, Great Lakes Commission, American Meteorological Society, Interstate Council on Water Policy, and Environmental Protection Agency made similar recommendations.

We have before us an incredible opportunity to create a national drought policy for the United States that acknowledges current and escalating risks associated with drought and emphasizes mitigation and preparedness as a means to reduce these risks for future generations. To accomplish this goal, the Commission must recognize regional differences in our nation's vulnerability to drought and provide incentives to foster improved preparedness and innovative mitigative measures. Thus, our *national* drought policy should acknowledge these regional differences and propose regional solutions that address these differences.

In October, the National Drought Mitigation Center, with sponsorship from the U.S. Bureau of Reclamation, conducted a drought planning workshop in collaboration with the U.S./Mexico International Boundary and Water Commission, Comision Nacional del Agua, and the Instituto Mexicano de Tecnología del Agua in Cuernavaca, Mexico. This very successful workshop is seeking to develop a joint drought mitigation program between the United States and Mexico, particularly in the border states region. This workshop followed several years of drought in northern Mexico and drought conditions in Texas and New Mexico in 1996 and 1998.

Drought Network News readers are encouraged to submit articles, announcements, and other information of interest to our network members. **The deadline for submitting material for the February 1999 issue of the newsletter is January 4, 1999.**

Donald A. Wilhite

Contents

Droughts in Tamil Nadu:
A Qualitative and Quantitative Appraisal

Tamil Nadu experiences recurrent droughts. Tamil literature also indicates that famine-like conditions prevailed during the Pandiyan Kingdom for nearly 12 years. The state normally benefits from northeast monsoon rainfall from October to December, unlike other regions of India, which are dominated by southwest monsoon rainfall.

In general, four major parameters determine the nature and extent of drought conditions in Tamil Nadu: (1) rainfall, (2) ground water, (3) reservoir levels, and (4) crop conditions. It is estimated that nearly 50% of the districts in the state are drought-prone. The state receives nearly 80% of its annual rainfall during the northeast monsoon, whereas it experienced below-normal rainfall in the southwest monsoon for 30% of the years in the last 25 years. During the southwest monsoon period, water demand always exceeds rainfall, but the water deficit is quite low in the northeast monsoon period. Hence, due to severe water deficit, drought recurs during the southwest monsoon and also in summer months in Tamil Nadu.

The severity and extent of drought in the state is believed to be the result of aberrations in rainfall, overexploitation of ground water, lower reservoir levels, and crop stress conditions. Red, black, and alluvial soil types predominate in Tamil Nadu, but sandy soils in the southeast part of the state are prone to chronic droughts. This article discusses and apprizes the qualitative and quantitative aspects of rainfall climate, drought profile, episodic drought events, remedial drought measures, and drought management. This information may serve as feedback for policy makers and administrators in evolving strategies.

Mean Annual Rainfall (mm)	Districts
<800	Coimbatore
800–1,000	Pudukottai, Tirunelveli, Ramanathapuram, Madurai, Salem, Dharmapuri, North Arcot, Tiruchchirappalli
1,000–1,200	South Arcot and Tanjavur
1,200–1,400	Madras and Chingleput
1,400–1,800	Kanyakumari
>1,800	The Nilgiris

Table 1. District rainfall in Tamil Nadu.

Climate Pattern

The state's climate may be characterized as dry subhumid to semiarid. The state has three distinct rainfall climates: (1) southwest monsoon (June–September), (2) northeast monsoon (October–January), and (3) dry season (February–May). The state's cropping system centers on the northeast monsoon season. Tamil Nadu is classified into seven agroclimatic zones: northeast, northwest, west, south, higher rainfall zone, high altitude hilly, and cauvery delta zone. Of these, the most fertile zone is the cauvery delta zone, which is located in the humid tropics. It has a mean annual rainfall of 1,273 mm, mostly contributed by the northeast monsoon. The state has a normal annual rainfall of 945 mm, with 45 rainy days. Table 1 shows district rainfall in the state.

Regarding soil moisture and water deficit, some stations experience more deficit in summer than in winter. Table 2 shows the variation in climatic moisture status in Tamil Nadu. The state as a whole is water deficient. The northeast zone, comprising the Tiruchchirappalli, North Arcot, and Chingleput districts, experiences cyclones during the winter. The

Station		Seasonal PET	Seasonal Rainfall	Soil Moisture	Water Deficit
Vellore	I	690	634	3	137
	II	788	340	369	171
Salem	I	644	621	71	0
	II	892	217	550	73
Coimbatore	I	642	297	335	0
	II	801	248	511	61
Tiruchchirapalli	I	992	448	580	0
	II	858	331	500	73
Madurai	I	708	475	285	4
	II	794	344	402	100
Pamban	I	767	225	607	0
	II	854	671	391	73
Palayankottai	I	845	210	675	0
	II	829	489	369	7
	I	Winter			
	II	Summer			

Table 2. Climatic moisture status of Tamil Nadu.

mean annual rainfall in the zone is 1,054 mm; of this, 500 mm is contributed by the northeast monsoon. The northwest zone has an annual rainfall range of 560–1,080 mm, while the hilly regions receive 1,300 mm annually. Districts like Dharmapuri and Salem, which are in this zone, receive 45% of their annual rainfall from the southwest monsoon. The districts of Periyar, Coimbatore, Salem, and North Madurai are in the west zone, which has a mean annual rainfall of 635 mm. This zone has a semiarid to subhumid climate with frequent droughts. In this region, almost half the rainfall is from the northeast monsoon. The cauvery delta zone has a tropical climate, with a mean annual rainfall of 1,278 mm. The southern zone of Tamil Nadu, comprising the districts of Ramanathapuram, Tirunelveli, Dindigul, South Madurai, and Pudukottai, is under the rain shadow region, having a prolonged dry climate. Only northeast monsoon rainfall is dependable here. Hence, the mean water deficit exceeds rainfall in all months except October and November.

Tamil Nadu has 8 drought-prone districts covering 833,997 km^2, or about 64% of the total area of the state. The drought-prone districts are Coimbatore, Dharmapuri, Kanyakumari, Madurai, Ramanathapuram, Salem, Tirunelveli, and Tiruchchirappalli. Coimbatore district has erratic and unpredictable rainfall. About 30% of the district's annual rainfall is recorded in the southwest monsoon and 50% is contributed by the northeast monsoon through cyclonic activity. Generally, rainfall decreases from north to south. Dharmapuri district has pleasant dry weather, with most of its rainfall coming from the southwest monsoon. Because of its close proximity to the sea, Kanyakumari has a maritime climate. Here the southwest monsoon begins in June and lasts until September. The rainfall in this region is provided equally by the southwest and northeast monsoons. In the Madurai region, 29% of the annual rainfall is contributed by the southwest monsoon and 42% by the northeast monsoon. Because of variations in the district's topography, the rainfall is erratic in time and space. A dry and hot climate prevails in Ramanathapuram, with only 24% of the annual rainfall coming from the southwest monsoon and 53% coming during the winter monsoon. Salem district has a dry temperate climate, while Tiruchchirappalli is predominantly a dry zone, with 33% of its annual rainfall from the southwest monsoon and the rest from the northeast monsoon. Tirunelveli is a hot tropical region with nearly 60% of its annual rainfall occurring from October to December.

Drought Pattern during 'Kharif' Period

Although the northeast monsoon has a major impact on rainfall distribution and cropping patterns in Tamil Nadu, most of the droughts occur in the southwest monsoon or kharif season (June–September). An analysis of rainfall from 1871 to 1985 shows 4 consecutive years of deficit rainfall from 1928 to 1931 and 3 consecutive years of deficit rainfall from 1968 to 1970. These had a great impact on ground water levels, reservoir levels, crop conditions, and soil moisture. Sandy soils in the region are more prone to severe drought. Recent droughts occurred in 1966, 1967, 1979, 1982, 1986, 1987, and 1989. Each of these droughts posed different types of problems. Some of the droughts were chronic or severe and some were mild.

During the 1966 drought, there were 2 consecutive weeks of severe drought, and no moderate droughts occurred during the kharif season. In 1967, there were 3 severe consecutive drought weeks followed by 3 weeks of moderate drought. In 1979, chronic drought occurred, with 9 consecutive weeks of severe droughts followed by moderate drought weeks, and a similar situation occurred in 1982. The droughts of 1986 and 1987 were also chronic and significant for India as well as Tamil Nadu. The problem was resolved by efficient management practices and through remedial measures by the state administration.

Impact of Some Significant Droughts

The drought of 1980 destroyed the groundnut crop, which covered about 1 lakh[1] ha in Chingleput and North Arcot districts of Tamil Nadu. As a result of the failure of the northeast monsoon in 1980, drought prevailed in 3 or 4 districts in early 1981. Thousands of coconuts dried up and mangoes were damaged. There was also an acute drinking water problem. Unemployment increased in handloom industries. During the 1982 drought, there were huge losses of paddy and groundnut. Even moisture-surplus regions like Nilgiri and Coonoor had severe drought, which resulted in the loss of about 6,000 ha of tea plantation. At the same time, during June to August, North Arcot district had a severe drought, resulting in transplantation of Samba variety of paddy of about 25,000 ha instead of the normal 80,000 ha. About 1 lakh ha of the groundnut crop was affected. Even Kuruvai variety of paddy (0.61 ha) was adversely affected because of the prolonged dry spell and rainfall failure.

The state lost crops such as paddy, pulses, and millets covering 1 lakh ha during the 1983 drought. Hydropower generation failures occurred because of the low level of water in the Mettur Dam. The 1985 drought resulted in an acute drinking water problem in Coimbatore, Trichy, Salem, Dharmapuri, and Madurai districts. The ground water level went below 2 meters in these regions.

The most alarming recent droughts occurred in 1987 and 1989. During 1987, about 108 lakh cattle were severely affected and catchment areas were nearly dry. There were 290 poor rainy days, 48 marginal rainy days, and 27 good rainy days in 1989, covering about 50% of the area. The ground water level fell more than 11 m below normal. The most severely affected crop was paddy, which was sown in an area of 20 lakh ha, compared to a target of 24 lakh ha. Paddy production also dropped by 10 lakh tons. Millet production decreased by 4 lakh tons and pulses decreased by 1 lakh ton.

Because of poor catchment and storage of water, the cropping pattern was changed to make the best use of the situation. The broadcast method of sowing was recommended to farmers. The impact of the 1989 drought was as critical as that of the 1987 drought in Tamil Nadu. Because of the acute shortage of water, the administration issued ration cards to people to collect drinking water at the various supply outlets. The water supply was made on alternate days only, because of low storage at Poondi, Red Hills, and Cholavaram reservoirs.

Anti-Drought Measures and Management

In Tamil Nadu, the labor force in the agrarian sector is substantial—about 30% of the total work force. This is higher than the all-India average of 23%. Hence, the labor force was employed on projects involving desilting work, strengthening bunds of irrigation tanks, constructing percolation ponds, and other moisture conservation measures. This type of work helped in drought proofing and capturing rainwater during monsoons and recharging the ground water potential.

Major work like afforestation and labor-oriented work was undertaken by the state forest department during the 1987 and 1989 droughts. The same department provided water facilities (through open and bore wells) for wildlife populations. A unique project undertaken by the state administration during this period was the establishment of about 20 ecological farms, covering almost all districts of Tamil Nadu. Another positive feature was the mass training of the coastal belt villagers of the state in fish farming.

To reduce the severe impact of drought on the cattle population, the state government gave full subsidy on paddy straw to poor farmers. This also

[1] 1 lakh = 100,000

prevented the need for cattle migration, and no cattle camps were needed. Distress sales of cattle were also negligible. Fodder production increased to 13,000 ha in drought regions. Drinking water facilities were provided for cattle by means of bore wells near water tubs.

As a contingency measure, seeds, fertilizers, and pesticides were distributed at subsidized rates to small and marginal farmers. For this, a sum of 45 lakh rupees was allotted by the agriculture department, benefitting 2 lakh farmers in the state. Table 3 gives an account of the expenditures incurred in drought management strategies in Tamil Nadu. A novel plan of "direct sowing" was adopted for the first time by the farmers in the Tanjavur region. Here the strategy was to raise a crop during rains and then, as the reservoir level in Mettur dam improved, release the water to supplement rainfall. However, this requires constant monitoring. The response from farmers was very good. It was said that the entire paddy (Samba variety) would have been lost but for the "direct sowing" plan. Because of this plan, about 49% of the area was brought under paddy and the production level was maintained despite drought in the region.

Thus it is apparent that the interactive approach between the public and the administration in managing droughts in Tamil Nadu is quite commendable. The people's participation in identifying extension priorities has produced "farmer friendly" packages that have been well received.

Year	Amount (Rs. in crores)	Year	Amount (Rs. in crores)
1966–67	2.739	1978–79	13.140
1968–69	2.450	1979–80	24.620
1969–70	17.408	1981–82	61.810
1972–73	7.809	1982–83	17.080
1973–74	8.261	1983–84	106.210
1974–75	21.420	1984–85	21.556
1975–76	33.760	1985–86	67.508
1976–77	33.510	1986–87	30.910
1977–78	58.720	1987–88	77.150

Table 3. Expenditure incurred on drought management in Tamil Nadu (1966–88).

K. K. Nathan
Senior Scientist
Water Technology Centre
Indian Agricultural Research Institute
New Delhi—110012
India

Comparative Hydrometeorology of Temperate and Semiarid Environments in India

Introduction

Out of a total cropped area of 178 m ha, India has 59 m ha of irrigated cropland. The remaining 119 m ha is rainfed. Crop production under rainfed conditions either occurs during the rainy season or depends on conserved or residual soil moisture. In temperate countries, the economy largely depends on production of goods and services that are less affected by the variabilities of weather. Although India receives adequate amounts of rainfall annually through the four different types of weather phenomena—southwest monsoon (74%), northeast monsoon (3%), pre-monsoon (13%), and post-monsoon (10%)—the distribution in time and space is erratic, resulting in a limitation on the length of crop-growing periods (LGP) or the occurrence of floods.

The temperate environment of Kashmir consists mainly of two crop growing seasons extending from May to October (summer) and November to April (winter). Rice, maize, cowpea, and beans are some of the important summer crops, while rapeseed, berseem, oats, and wheat are grown as winter crops. Under the semiarid conditions of Rajasthan, some

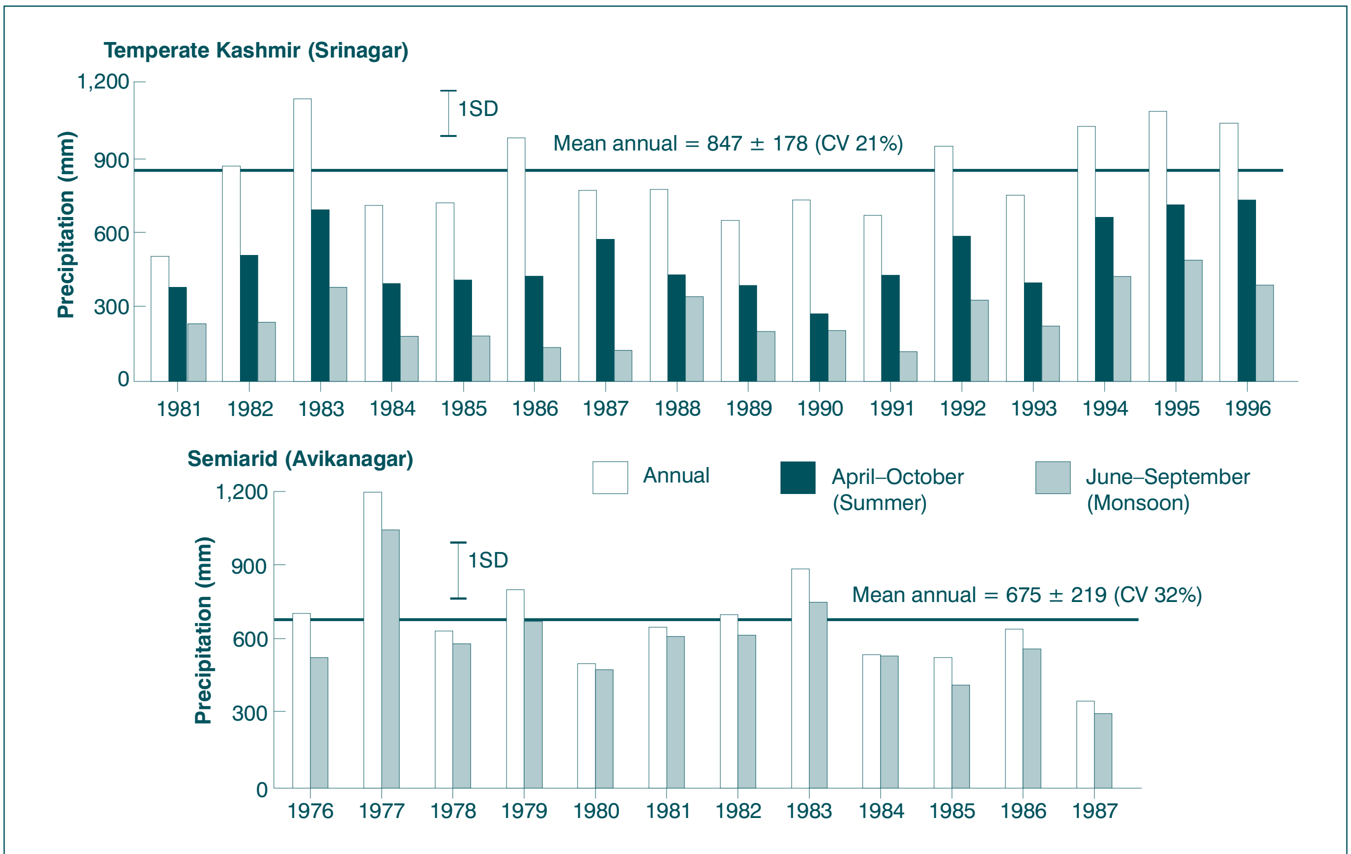

Figure 1. Comparative patterns of precipitation.

drought-resistant crops like pearl millet, cowpea, guar, and foxtail grass are cultivated during the summer monsoon season (June to September), while the ensuing winter season up to February experiences various degrees of moisture stress. Crops grown in this winter season are mostly irrigated. This season is followed by a third one, with hot and dry weather (February to June).

Rainfall Pattern

The characteristic patterns observed over the years are shown in Figure 1. The figure shows that variability occurs more in semiarid (CV=32%) than in temperate (CV=21%) environments. The Indian summer monsoon rainfall (June–September), which is known to contribute maximum rains through the southwest monsoon (74%), assumes less importance under temperate conditions. The same type of rainfall makes its maximum contribution under semiarid conditions. In temperate Kashmir, summer rainfall (April to October) is greater; this type of rainfall is more important for summer crop production in temperate environments.

Water Balance

The water balance figure for the two regions is shown in Figure 2. It shows that there is a small period of moisture stress under temperate conditions extending from June to September, whereas under semiarid conditions, moisture stress is prolonged and extends from November to June (8 months). Also, evaporation exceeds rainfall from April to mid-November under temperate conditions, but this phenomenon is quite extended in semiarid regions, indicating a severe limitation on the length of the crop-growing period. Most of the time the maximum temperature remains above 20° C under semiarid conditions, but temperature regimes of such magnitude are found only for 6 months (May to October) in temperate environments.

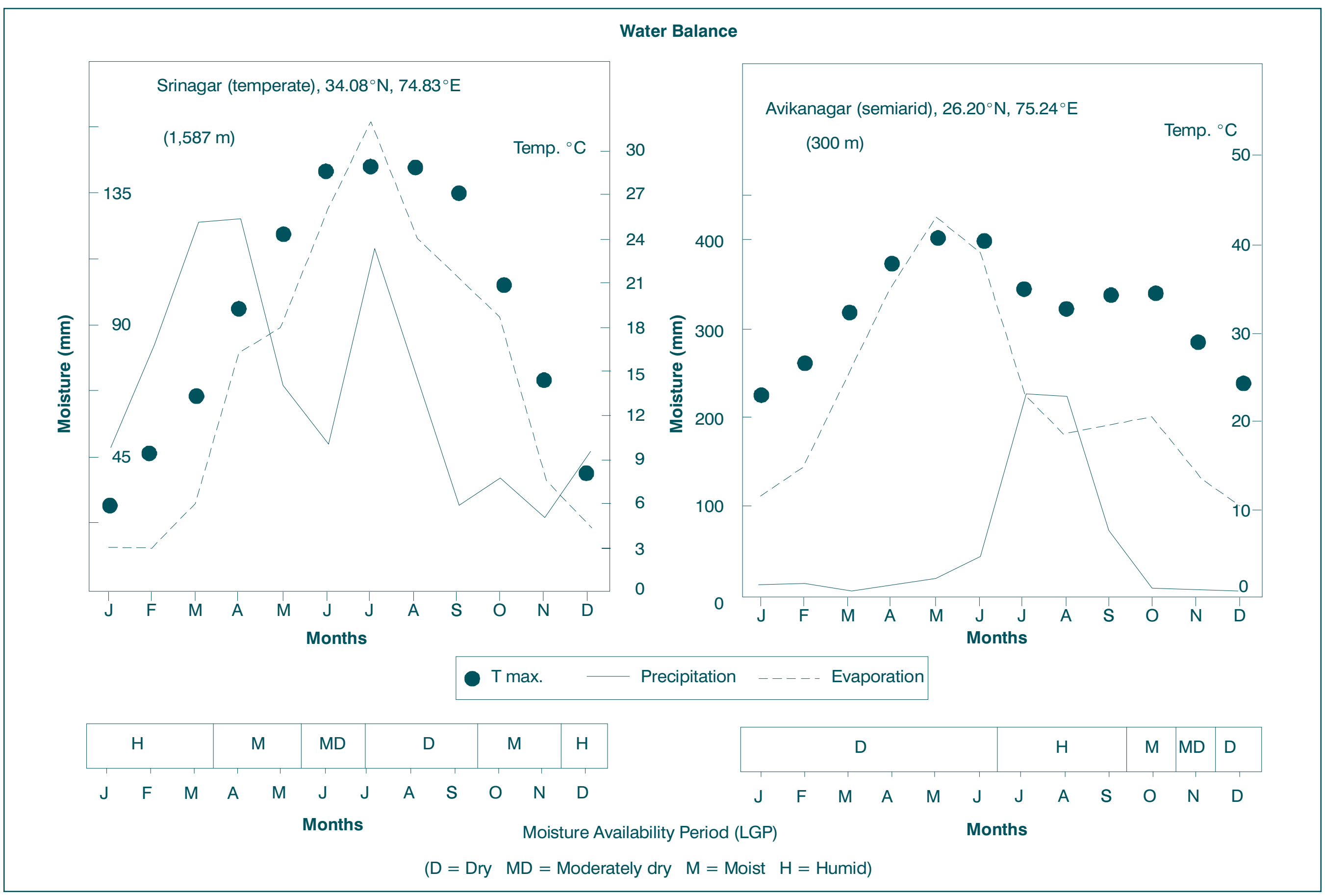

Figure 2. Water balance for Srinagar and Avikanagar.

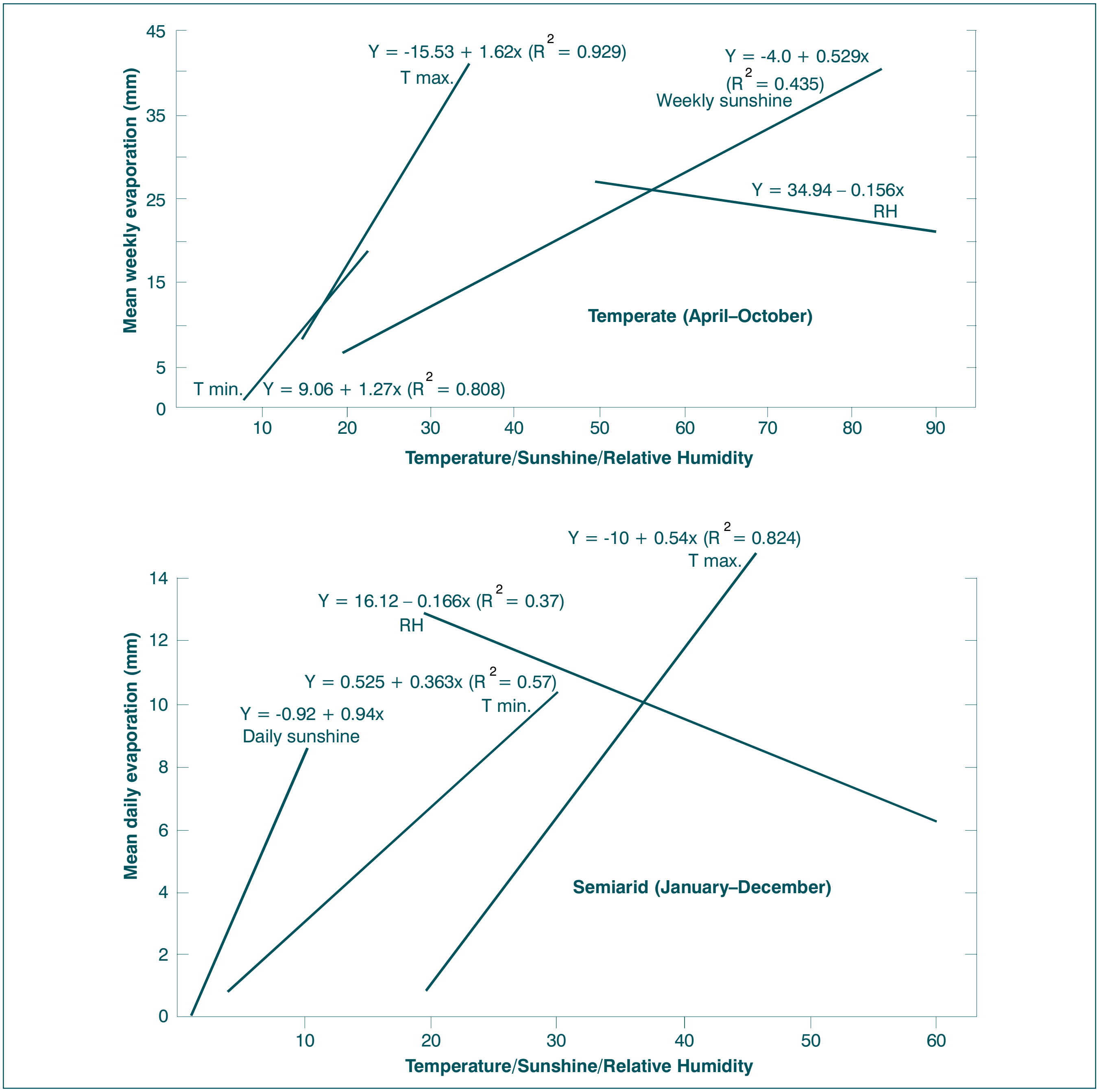

Figure 3. Regression equations of various weather variables in relation to evaporation.

Evaporation

The regression equations of various weather variables in relation to evaporation are shown in Figure 3. Here evaporation has been taken as the dependent variable (Y), and an analysis of the graphs shows its maximum dependence on maximum temperatures under both temperate and semiarid environments. It is also quite clear from the figure that all weather variables except relative humidity have been found to be positively correlated with evaporation.

Dr. Badrul Hasan
Associate Professor (Agronomy)
SKUAST
C/O P.O. Box 706
GPO
Srinagar, Kasmir
India

Persian Gulf Sea Surface Temperature as a Drought Diagnostic for Southern Iran

The Persian Gulf and Oman Sea, situated over the northwestern extremity of the tropical Indian Ocean, make up the southern border of Iran (Figure 1). During hot seasons, the sea surface temperatures (SSTs) of these water bodies are high, and a huge thermal trough system is usually dominant over the region (Bitan and Sa'aroni, 1992). The summer SSTs of the Persian Gulf are reported to be the highest in the world (Gabler, 1977).

About 30% of the total rain-bearing air masses coming to the country originate in north Africa, the Red Sea, and western Saudi Arabia (Khalili, 1992). These air masses are known as the Sudan Current; they are categorized as tropical maritime. They produce a significant portion of the total annual rainfall over the southern parts of Iran. Figure 2 shows that the general trajectory of the Sudan Current passes over Saudi Arabia and enters Iran through the Persian Gulf. The occurrence of some heavy winter rainfalls in Shiraz, Fasa, Bushehr, and Bandar Lengeh (Figure 1) is attributed to the movement of the Sudan Current toward Iran (Khalili, 1992).

Nazemosadat et al. (1995) have annualized the relationships between Iranian seasonal rainfall and the Persian Gulf SSTs. The SST data for five 2° by 2°

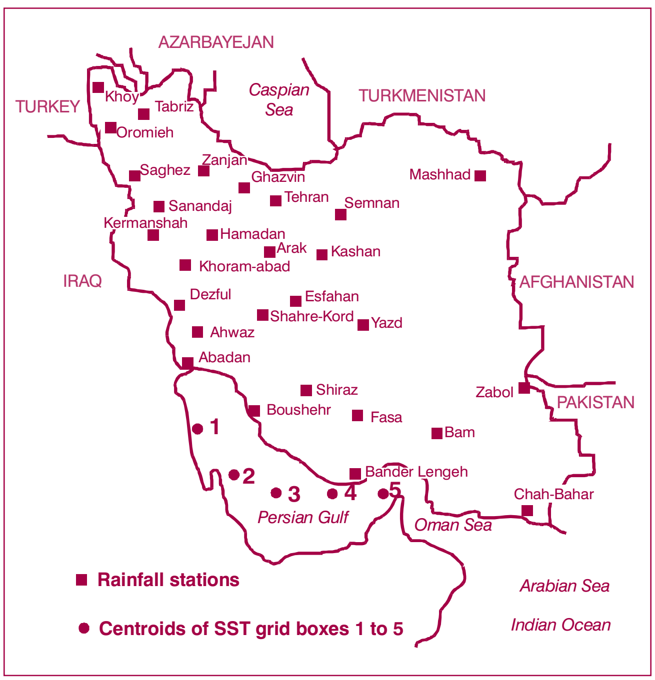

Figure 1. The geographical location of Iran, rainfall stations, and the approximate centroid of SST grid cells.

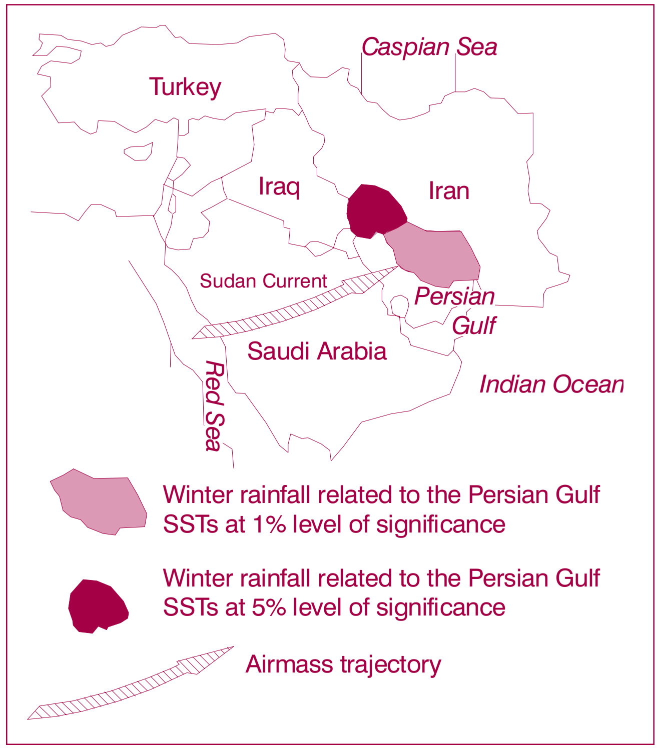

Figure 2. General trajectories of the rain-bearing air masses that cross the Persian Gulf during the winter.

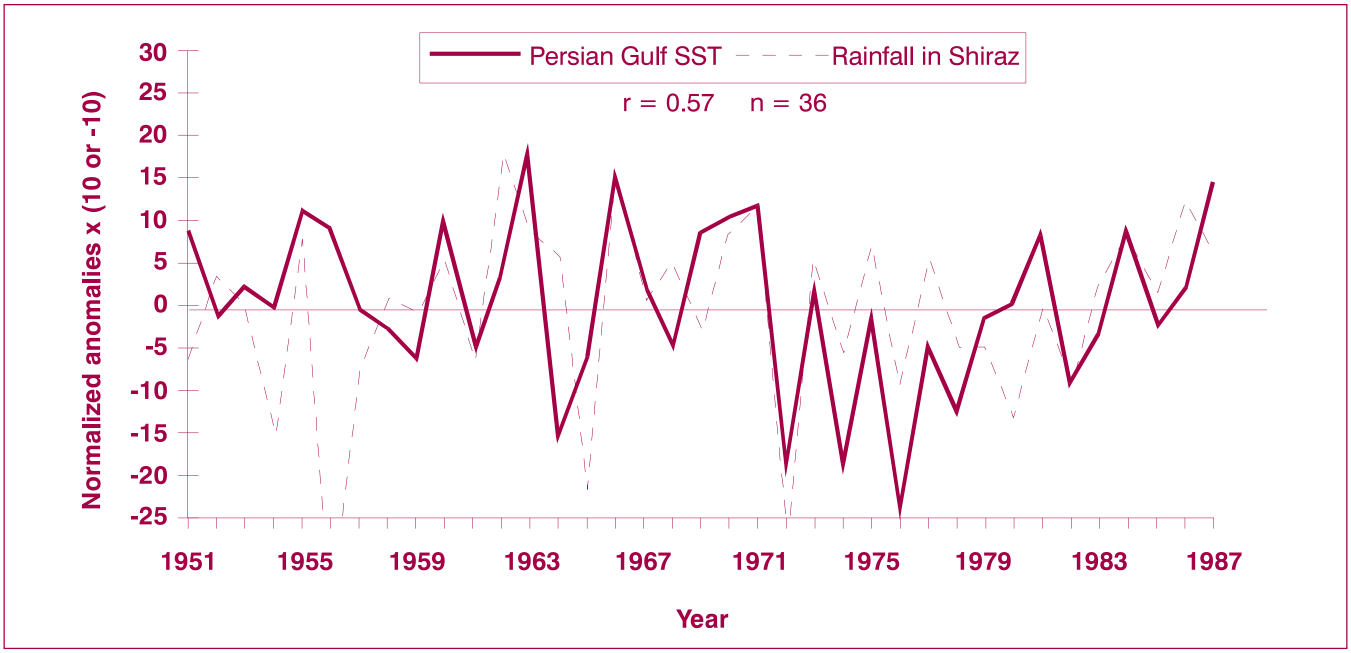

Figure 3. Fluctuations of the Persian Gulf SSTs and winter rainfall in Shiraz. Normalized anomalies of variables multiplied by 10 for SST and -10 for rainfall data. The SST–rainfall correlation is highly significant.

COADS grid cells over the Persian Gulf were selected in this analysis (Figure 1). Their study revealed that winter (January–March) rainfall over the southern and southwestern parts of Iran is negatively correlated with the Persian Gulf SSTs. The spatial distribution of the correlation field between the Persian Gulf SSTs and rainfall data is delineated in Figure 2.

Drought (flooding) spells over southern and southwestern parts of Iran are, therefore, expected when the Persian Gulf SSTs are above (below) normal. The concurrent variations of Shiraz rainfall and the Persian Gulf SSTs for the period 1951–87 are shown in Figure 3. Data are shown by their normalized anomalies multiplied by -10 and 10 (for rainfall and SST data, respectively) to be more compatible. Drought (wet) episodes are hence denoted by positive (negative) rainfall anomalies. Shiraz is at the northern extremity of the areas whose rainfall is affected by the Sudan Current and is, therefore, suitable for such examination.

As Figure 3 shows, winter droughts and wet periods tend to occur for the episodes in which the Persian Gulf SSTs are above and below normal, respectively. For example, droughts in 1955, 1960, 1962, 1963, 1966, 1970, 1971, 1984, and 1987 coincide with the above-normal Persian Gulf SSTs. For these episodes, the measured SST data varied from 0.4° to 1.8° above normal. In contrast, above-normal rainfall generally occurred when the Persian Gulf SSTs were below normal (for example, 1956, 1957, 1965, 1972, 1976, and 1982).

Overall, correlation analysis between rainfall and SST data, using various data lengths, has revealed that the fluctuations of SST account for about 40% of rainfall variability over the region studied. The relationships are generally strong for Boushehr, Shiraz, Fasa, and Bandar Lengeh and weaker for Abadan and Ahwaz (Figure 2). The Persian Gulf SSTs can hence be used as a drought diagnostic over southern parts of Iran. However, further research is needed to identify other climatic indices influencing rainfall variability over these regions.

M. Jafar Nazemosadat
Irrigation Department
Agricultural Faculty
Shiraz University
Shiraz, Iran
Fax: +98 71 28193
e-mail: jafar@hafez.shirazu.ac.ir

References

Bitan, A.; and H. Sa'aroni. 1992. "The horizontal and vertical extension of the Persian Gulf pressure trough." *International Journal of Climatology* 12: 733–47.

Gabler, R. E.; R. J. Sager; S. Brazier; and J. Pourciau. 1977. *Essentials of Physical Geography*. Holt, Rinehart and Winston, New York.

Khalili, A. 1992. *Fundamental Study of Iranian Water Resources, Climatological Understanding of Iran*, Parts 1 and 2. Jamab consultant reports, the Iranian Ministry of Energy (in Persian).

Nazemosadat, M. J.; I. Cordery; and S. Eslamian. 1995. "The impact of the Persian Gulf sea surface temperature on Iranian rainfall." *The Proceedings of the Regional Conference on Water Resources Management*, Isfahan, Iran.

Announcements

IUGG–99 XXII General Assembly
Inter-Association Symposium on Geophysical Hazards: Risk Assessment, Mitigation and Warning Systems

The IUGG–99 XXII General Assembly Inter-Association Symposium on Geophysical Hazards: Risk Assessment, Mitigation and Warning Systems will be held July 22–27, 1999, in Birmingham, United Kingdom. The aim of this Inter-Association Symposium is to stimulate synergistic interactions between all geophysicists on common interests in the field of natural hazards, especially across disciplinary boundaries. The scope seeks through contributed presentations to recognize the technical and scientific progress made during the last ten years toward accomplishing the goals set forth for the International Decade for Natural Disaster Reduction, including risk assessment, the application of known preparedness and mitigation approaches, and the development and use of scientific and engineering knowledge to improve warning systems. A series of invited keynote lectures will be presented on July 22 to evaluate the state-of-the-science in geophysical hazards and risks.

The deadline for submission of abstracts (English or French) is January 15, 1999. Instructions for abstract submission and format can be found at the IUGG website: http://www.bham.ac.uk/IUGG99/, or by writing to any of the co-convenors listed below. Please specify the symposium code (JSP23) and the symposium title.

(IAPSO): Mohammed El-Sabh, Centre Océanographique de Rimouski, Département d'océanographie, Université du Québec à Rimouski, 310 Allée des Ursulines, Rimouski (Québec), G5L 3A1, CANADA
IASPEI: Juan Manuel Espinosa-Aranda, Mexico < maranda@servidor.unam.mx>; and Yong Chen, P.R. China <chenyong@sun.ihep.ac.cn>
IAVCEI: Brad Scott, New Zealand <B.Scott@gns.cri.nz>
IAHS: Lars Gottschalk, Norway <Lars.Gottschalk@geofysikk.uio.no>
IAG: Yehuda Bock<bock@pgga.ucsd.edu>
IAGA: Susan McLean,U.S.A. <smclean@ngdc.noaa.gov>
IAMAS: Tom Beer, Australia <tom.beer@dar.csiro.au>
IUGG Tsunami Commission: V. K. Gusiakov <gvk@omzg.sscc.ru>
ILP: Friedemann Wenzel, Rumania <fwenzel@riskinc.com> or <fwenzel@ibm.com>

1999 National Disaster Medical System Conference

The National Disaster Medical System (NDMS) will hold its annual conference at the Omni Shoreham Hotel in Washington, D.C., May 7–12, 1999. The 1999 NDMS Conference will provide practical information on implementing domestic and international strategies for preventing or reducing the health and medical consequences of disasters of any origin. The education will feature counter-terrorism programs, clinical updates, extreme environmental events, disaster team development, information management systems, mass gathering events, critical incident stress management, sheltering and congregate care, health system emergency planning, mass fatality operations, and new standards in emergency management. The program will offer approximately 20 hours of continuing education credit for a wide range of health practitioners and administrators. For additional information, contact NDMS by calling 1–800–USA–NDMS and pressing the "star" key, by e-mail at ndms@usa.net, or check their website at www.oep-ndms.dhhs.gov.

International Conference on Integrated Drought Management—Lessons for Sub-Saharan Africa

The International Conference on Integrated Drought Management—Lessons for Sub-Saharan Africa will be held September 20–22, 1999, in Pretoria, South Africa. The Conference is a contribution to the International Hydrological Programme (IHP) of UNESCO and the International Decade for Natural Disaster Reduction (IDNDR) of the United Nations. The objective of the Conference is to better understand the factors predisposing people and landscapes to heightened drought vulnerability, and to find strategies and actions that can reduce drought vulnerability and move toward sustainable development. Main themes include understanding, measuring, and forecasting drought; comparative drought management polices; strategies to reduce drought vulnerability; integrated drought management toward sustainable development; drought research and information needs; and major lessons for more effective drought management for sub-Saharan Africa. The Conference is aimed at researchers, academics, practitioners, consultants, developers, policy makers, planners, community leaders, and the media. For more information, contact Conference Planners, P.O. Box 82, Irene, 0062, South Africa, or send e-mail to confplan@iafrica.com.

4th International Congress on Energy, Environment and Technological Innovation

The 4th International Congress on Energy, Environment and Technological Innovation will be held in Rome in September 1999. It is the latest in a series of Congresses on the same theme that have been held in Caracas (1989 and 1995) and Rome (1992). This fourth Congress is organized by "La Sapienza" and "Roma Tre" Universities, and Universidad Central de Venezuela.

The brochure and application form for this event are available on the conference website: http://www.ing.ucv.ve/ceait/eeti.htm. This information is also available from EETI99—Universidad Central de Venezuela, Facultad de Ingeniería—P.O. Box 50656, Caracas 1050, Venezuela; e-mail: eeti99@camelot.rect.ucv.ve; phone: ++ 58-2-605 3086; fax: ++ 58-2-605 3086; or from EETI99—Universitá degli Studi de Roma "La Sapienza", Facolta di Ingegneria, Vía Eudossiana, 18-00184 Rome, Italy; e-mail: eeti99@minerva.ing.uniroma1.it; Internet: http://minerva.ing.uniroma1.it; phone: ++39-6-44585764/44585524; fax: ++ 39-6-4883235.

Let Us Know . . .

If your address has changed or needs to be corrected, if you are receiving duplicate mailings, or if you're no longer interested in receiving ***Drought Network News****, would you please help us keep our mailing list up to date by filling out the form below and returning it to:*

IDIC/NDMC
239 L. W. Chase Hall
University of Nebraska
P.O. Box 830749
Lincoln, NE 68583–0749
USA
Telephone (402) 472–6707
Fax (402) 472–6614
e-mail ndmc@enso.unl.edu

If responding by conventional mail, please return this form with the mailing label still attached to the reverse side (non-U.S. members: please include the mailing label from the envelope). If responding by e-mail or fax, please include your old address as well as your new address.

____ Change/correction of address
____ Receiving duplicate mailings (please include mailing labels from all duplicates)
____ Delete my name from the *Drought Network News* mailing list

Name ______________________________

Organization ______________________________

New/Corrected Address ______________________________

____

____

____

Telephone ______________________________
Fax ______________________________
e-mail ______________________________

Drought Network News is published three times a year by the International Drought Information Center (IDIC) and National Drought Mitigation Center (NDMC). The IDIC and NDMC are part of the School of Natural Resource Sciences at the University of Nebraska–Lincoln. Funding for the newsletter is provided by the International Activities Division, National Weather Service/NOAA, through their cooperative program with the World Meteorological Organization, and Cooperative State Research, Extension, and Education Service, U.S. Department of Agriculture.

Drought Network News encourages readers to submit information on current episodes of drought and its impacts; timely reports of response, mitigation, and planning actions of governments and international organizations (successes *and* failures); recent research results and new technologies that may advance the science of drought planning and management; recent publications; conference reports and news of forthcoming meetings; and editorials. If references accompany articles, please provide *full bibliographic citations*. All artwork *must* be *camera-ready*—please provide clear, sharp copies (in black/gray and white only—we are unable to reproduce color artwork) that can be photocopied/reduced without losing any detail. Correspondence should be addressed to

Drought Network News
IDIC/NDMC
239 L. W. Chase Hall
University of Nebraska
P.O. Box 830749
Lincoln, NE 68583–0749
USA

Telephone: (402) 472–6707
e-mail: ndmc@enso.unl.edu
WWW: http://enso.unl.edu/ndmc

Subscriptions to ***Drought Network News*** may be obtained, free of charge, by contacting Kim Klemsz at the street or e-mail address or the telephone or fax number to the left.

Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln

IDIC/NDMC
239 L. W. Chase Hall
University of Nebraska
P.O. Box 830749
Lincoln, NE 68583–0749
USA