Drought and Water Allocation

Compiled by Mary Stevanus
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This bibliography lists 71 articles on water allocation as it relates to drought and water shortages dated 1992 - 1999. Competition for water resources, legal rights and remedies, and economic options are highlighted. All articles are from the AGRICOLA database.

This electronic bibliography is intended primarily to provide awareness of recent investigations and discussions of a topic and is not intended to be in-depth and exhaustive. The inclusion or omission of a particular publication or citation should not be construed as endorsement or disapproval. Citations are arranged alphabetically by title and abstracts are included where available. All citations are in English unless otherwise noted.

Send suggestions for electronic bibliographies related to water resources and agriculture to wqic@ars.usda.gov.

To locate a publication cited in this bibliography, please contact your local, state, or university library. If you are unable to locate a particular publication, your library can contact the National Agricultural Library (please see "Document Delivery Services" at http://www.nal.usda.gov/ddsb/).

1. **Agriculture and the everglades.**
   Stone, J. A. and Legg, D. E.
   NAL Call #: 56.8-J822

   *Descriptors*: agricultural-development, crop-production, drained-conditions, agricultural-land, muck-soils, environmental-impact, drainage-water, natural-grasslands, swamps, aquatic-environment, water-pollution runoff, phosphorus, eutrophication, water-flow,

2. **Appraisal and optimization of agricultural water use in large irrigation schemes. II. Applications.**
   Menenti, M., Chambouleyron, J., Morabito, J., Fornero, L., and Stefanini, L.
   NAL Call #: TC401.W27

   *Descriptors*: irrigation-systems, irrigation-water, water-use, surface-water, groundwater, simulation-models, optimization, case-studies, water allocation, Argentina.

3. **Benefits of transferring streamflow priority from agricultural to non-agricultural use.**
   Bosch, D. J.
   NAL Call #: 292.9-AM34


   **Abstract**: In Virginia, as in many states, priority to streamflow is held by riparian landowners who are predominantly agricultural users. The streamflow may also have a high potential value to nonagricultural users who do not have riparian rights. The potential benefits of transferring streamflow priority rights from agricultural to non-agricultural use were evaluated using simulation for an eastern Virginia watershed. Lowering irrigators' priority to streamflow reduced crop yields and irrigated returns in some years because of inadequate water supplies. However, the transfer of priorities increased the likelihood that the urban reservoir would be able to withdraw water from the stream without interruption. As a result, priority trades reduced the size of reservoir needed to meet a given water requirement by municipal users. The resulting savings in reservoir construction and maintenance costs more than offset the losses to irrigators. Net savings could be achieved even if the reservoir were required to release water periodically to maintain a minimum level of instream flow. The conclusion is that the state should encourage trading of access to streamflow in order to increase the use efficiency of streamflows. Alternative means by which the state can facilitate water exchanges are discussed.

4. **Challenges in waterfowl habitat restoration of the Mono Lake Basin.**
   Reid, F. A., Drewien, R. C., and Ratcliff, T. D.
   NAL Call #: 412.9-N814

   *Descriptors*: water allocation, water-flow, California.
5. **Changing the balance in western water law? Montana reservation system.**
   Mcnally, M. and Matthews, O. P.
   *Nat-resour-j.* Albuquerque, University of New Mexico School of Law. Summer 1995. v. 35 (3) p. 671-693.
   NAL Call #: HC79.E5N3

   *Descriptors:* water-policy, law, water-systems water-use, rivers, water allocation, Montana, prior-appropriation-doctrine, Missouri-river.

6. **Changing water allocations and land use and the design of small scale irrigations schemes.**
   Steenbergen, F. van
   NAL Call #: TC801.I66

   *Descriptors:* irrigation-systems, design, water allocation, land-use, Pakistan.

7. **Competing water needs: agriculture, municipal/industrial and the environment.**
   Bach, M.
   NAL Call #: 282.9-G7992

   *Descriptors:* water-use, rural-urban-relations, water allocation, New Mexico.

8. **Conflict for water.**
   Chitale, M. A.
   NAL Call #: TD201.W346

   *Descriptors:* water-resources, water-policy, water allocation, water-management.

9. **Contract for nonbeneficial use: New Mexico water law is drowned out by contract.**
   Singdahlsen, W.
   NAL Call #: HC79.E5N3

   *Descriptors:* water allocation, water-use, right-of-access contracts, law, courts, decision-making, land-ownership, New Mexico.

10. **Designing water institutions: market failures and institutional response.**
    Livingston, M. L.
    NAL Call #: TC401.W27

    *Descriptors:* water-resources, water-policy, water-use, water allocation, water-management, water-costs, market-transfer, market-transfer-of-water, water-law, water-
Efficient resource use is increasingly central to the economic well-being of individual regions and countries. Institutional arrangements set the ground rules for resource use. At best, institutions facilitate achievement of economic and social goals. At worst, they establish impediments to efficient resource use and significant resources must be expended by individuals to compensate for their obsolete or poor design. In general, efficient water use requires a secure and flexible system of water rights. In the first regard, the peculiar physical characteristics of water resources pose special challenges for institutional design. Water resources are prone to market failures that must be addressed by institutions in order to yield efficient allocation and use. A section of the paper is devoted to presenting institutional approaches to establishing security in water use. Proportionality, prioritized rights and licenses are discussed in terms of their advantages and disadvantages. Concerning flexibility, water allocations must change in response to changing physical and economic circumstances. In the context of drought, administrative rationing, priority and drought water options are analyzed. For demand-based transfers, a full range of institutional options are considered, from a complete ban on transfers to no restriction, including market and administratively based transfers. The special issues of infrastructure, transactions costs, and secondary impacts are also discussed. Finally, conclusions are drawn concerning how the mix of institutional arrangements affects incentives guiding water use.

### 11. The determinants of perceptions of fairness in the allocation of water to multiple uses.

Syme, G. J. and Nancarrow, B. E.


NAL Call #: 292.8-W295

*Descriptors*: water allocation, water-use, decision-making philosophy, attitudes, perception, case-studies, New-south-wales, Victoria, western-australia, tasmania, equitable-water allocation.

*Abstract*: Five water allocation case studies were examined from four states in Australia. Issues varied from allocation between irrigators to that of 12 competing uses. The attitudinal and philosophical determinants of the fairness of the decision making for case studies separately and collectively were determined for a water-literate community. Agreement with general philosophical attitudes, rated importance of philosophical principles in decision making in each case study, and attitudes towards localized issues could, in combination, clearly discriminate people's differential perceptions of the fairness. It was also found that there was consistency in the importance placed on philosophical principles across the case studies. These principles can be used as a basis for empirical community evaluation of the fairness of decision making in water allocation.

### 12. Determining what is in the public welfare in water appropriations and transfers: the intel example.

*Nat-resour-j*. Albuquerque, University of New Mexico School of Law. Winter 1996. v.
13. **District control of water transfers likely to benefit landowners.**
   Smith, R. T.
   NAL Call #: 100-C12CAG

   **Descriptors:** water-use, irrigation-water, trading, water allocation, cost-benefit-analysis, distribution, landowners, tenants, local-government administration, water-policy, California.

14. **Drought by legislation.**
   Engle, M.
   NAL Call #: SB379.A9A9

   **Descriptors:** water allocation, drought, state-government law, winter, water-supply, agriculture, urban-areas, California.

15. **Economic and hydrologic implications of suspending irrigation in dry years.**
   Keplinger, K. O., McCarl, B. A., Chowdhury, M. E., and Lacewell, R. D.
   NAL Call #: HD1750.W4

   **Descriptors:** aquifers, irrigation, drought, water allocation, irrigated-farming deficiency, payments, water-policy, water-use, cost-analysis, stream-flow, Texas, Edwards-aquifer.

16. **Economic and political considerations in regional cooperation models.**
   Dinar, A. and Wolf, A.
   NAL Call #: HD1773.A2N6

   **Descriptors:** water allocation, resource-allocation, game-theory, cooperation, economic-analysis, social-accounting, politics, probability, mathematical-models, scarce-resources, water-transfers, coalition-formation, political-accounting-systems.

17. **Economic degradation, conservation and allocation of water resources.**
   Llop, A.
   NAL Call #: HC55.N3
18. Economic incentives reduce irrigation deliveries and drain water volume.
Wichelns, D., Houston, L., and Cone, D.
NAL Call #: TC801.I66

Descriptors: irrigated-farming, irrigation-scheduling, irrigation-requirements, water-costs, incentives, drainage-water volume, water-quality, water allocation, irrigation-equipment, prices, price-policy loans, field-crops, vegetables, California, low-interest-loans, irrigation-depth, tiered-water-pricing.

19. Establishing tradable water rights: implementation of the Mexican water law.
Rosegrant, M. W. and Gazmuri Schleyer, R.
NAL Call #: TC801.I66

Descriptors: irrigation-water, water allocation, law, water-policy, water-resources, trade, legal-rights, irrigated-farming, water-use, Mexico, market-oriented-water-policy.

Meinzen Dick, R.
NAL Call #: TC801.I66

Descriptors: irrigated-farming, irrigation, farmers, organizations, farmers'-associations, irrigation-water, irrigation-scheduling, farmers'-attitudes, participation, water-policy, water allocation, Philippines, Sri-lanka, Pakistan, Senegal, Mexico, western-states-of-usa, water-use, Columbia-basin-area-of-usa.

21. From reclamation to reallocation of western water.
Tarlock, A. D.
NAL Call #: 56.8-J822

Descriptors: water-resources, water-conservation, water allocation, water-supply, reclamation, western-states-of-usa.

22. How to accommodate an uncertain future into institutional responsiveness and planning: the case of Mexico and the United States.
Szekely, A.
NAL Call #: HC79.E5N3
23. **The increasing role of states in water management.**
   Jacobs, J. J. and Taylor, D. T.
   NAL Call #: 100-W99-1

   **Descriptors:** water-policy, state-government, water-conservation, water-distribution, water-costs, water allocation, cost-benefit-analysis, Wyoming.

24. **Institutional feasibility of contingent water marketing to increase migratory flows for Salmon on the upper Snake River.**
   Huffaker, R., Whittlesey, N. K., and Wandschneider, P. R.
   NAL Call #: HC79.E5N3

   **Descriptors:** salmon, rivers, seasonal-migration, water-use, irrigation, public-utilities, water-allocation, markets, feasibility, water-policy, law, Idaho, hydropower-utilities.

25. **An intraseasonal dynamic optimization model to allocate irrigation water between crops.**
   Bryant, K. J., Mjelde, J. W., and Lacewell, R. D.
   NAL Call #: 280.8-J822

   **Descriptors:** irrigation-water, water allocation, irrigation-scheduling, crop-production, plant-competition, maize, dynamic-programming, maize, sorghum, cotton, simulation-models, seasonal-growth, Texas.

   **Abstract:** A dynamic programming model that allocates irrigations among competing crops, while allowing for stochastic weather patterns and temporary or permanent abandonment of one crop in dry periods, is presented. Fifteen intraseasonal irrigations are allocated between corn and sorghum fields on the southern Texas High Plains. Broad rules of thumb implied by the results suggest irrigating the driest field in any stage unless soil water is close to field capacity on both fields or below wilting point on corn. A crop simulation model is used to reduce the complicated decision rules into simpler strategies with similar net returns.

26. **Irrigation land management model.**
   Steiner, R. A. and Keller, A. A.
   NAL Call #: 290.9-AM3Ps-IR

27. Irrigation management institutions in transition: a look back, a look forward. 
Svendsen, M. and Meinzen Dick, R. 
*Irrig drain syst.* 11: 2 pp. 139-156. (May 1997). 
NAL Call #: TC801.I66

Descriptors: irrigation, management, organizations, water allocation, farmers' associations, irrigation-water, irrigation-scheduling, water-policy, water-management, water-use, water-rights.

28. The legal and administrative setting for the use of water resources in Mendoza, Argentina. 
Llanos, M. E. A. de. and Bos, M. G. 
NAL Call #: TC801.I66

Descriptors: water-resources, water-policy, water-management, irrigation, water allocation, law, irrigation-water, legal-rights, Argentina, water-law, water-rights.

29. Linking water market functioning, access to water resources and farm production strategies: example from Pakistan. 
Rinaudo, J. D., Strosser, P., and Rieu, T. 
NAL Call #: TC801.I66

Descriptors: irrigation-water, irrigation-channels, groundwater-extraction wells, surface-water, groundwater, irrigated-farming, water allocation, crop-production, water-costs, water-resources, markets, water-use, Pakistan-punjab, water-transactions.

30. Management of droughts and floods in the semiarid Brazilian Northeast—the case for conservation. 
Ponce, V. M. 
NAL Call #: 56.8-J822

Descriptors: water-management, drought, floods, semiarid-zones, water-conservation, water-use, water-allocation.

31. Managing the resources of Pyramid Lake, Nevada, amidst competing interests. 
Wagner, P. and Lebo, M. E. 
NAL Call #: 56.8-J822
Measuring regional economic impacts of streamflow depletions.
Leones, J., Colby, B., Cory, D., and Ryan, L.
NAL Call #: 292.8-W295

Abstract: Because of large upstream diversions for agriculture and an absence of policies to protect in-stream flows, flows in the Rio Grande near Taos, New Mexico, routinely are low by midsummer. The reach is a popular whitewater run in the southwestern United States when flows are adequate for river running. This article estimates the regional economic impacts attributable to summer streamflow depletions. Economic analysis indicates that while lower water levels affect the number of people coming to the region to raft on one river reach, low water levels had no effect on another nearby rafting area. Total expenditures and economic impacts were simulated for streamflows maintained at levels adequate for whitewater recreation throughout the summer season. These simulations indicate a 24% ($0.74 million) increase in rafting-linked expenditures and a 25% ($0.94 million) increase in value added from rafting, compared to actual 1992 expenditures and value added.

Mitigating environmental externalities through voluntary and involuntary water reallocation: Nevada's Truckee-Carson River Basin.
NAL Call #: HC79.E5N3

Modelling natural resource negotiations; an application to California water policy.
Adams, G. D., Rausser, G. C., and Simon, L. K.
NAL Call #: S1.W6

A multicriteria approach to allocating water during drought.
Ridgley, M. A.
NAL Call #: S900.R39

Descriptors: drought, water allocation, statistical-data models.

Mumme, S. P.
NAL Call #: HC79.E5E5

Descriptors: water-resources, water allocation, trade-agreements, water-policy, water-use, water-management, USA, Mexico, North-american-free-trade-agreement, nafta.

37. Once again on desertification.
Rozanov, B. G.
NAL Call #: 57.8-P34AE


38. Optimal reservoir operation for irrigation of multiple crops.
Vedula, S. and Mujumdar, P. P.
NAL Call #: 292.8-W295


Abstract: A model for the optimal operating policy of a reservoir for irrigation under a multiple crops scenario using stochastic dynamic programming (SDP) is developed. Intraseasonal periods smaller than the crop growth stage durations form the decision intervals of the model to facilitate irrigation decisions in real situations. Reservoir storage, inflow to the reservoir, and the soil moisture in the irrigated area are treated as state variables. An optimal allocation process is incorporated in the model to determine the allocations to individual crops when a competition for water exists among them. The model also serves as an irrigation scheduling model in that at any given intraseason period it specifies whether irrigation is needed and, if it is, the amount of irrigation to be applied to each crop. The impact on crop yield due to water deficit and the effect of soil moisture dynamics on crop water requirements are taken into account. A linear root growth of the crop is assumed until the end of the vegetative stage, beyond which the root depth is assumed to be constant. The applicability of the model is demonstrated through a case study of an existing reservoir in India.
39. Optimizing intra, and inter-seasonal water allocations from an irrigation reservoir.
   Evers, A. J. and Elliott, R. L.
   NAL Call #: 290.9-Am32P

   *Descriptors*: water allocation, irrigation-systems.

40. Perceptions of equity and procedural preferences for water allocation decisions.
   Syme, G. J. and Fenton, D. M.
   NAL Call #: HC10.S63

   *Descriptors*: water-resources, water allocation, attitudes, regional-surveys, case-studies, decision-making, Western Australia.

41. Performance based irrigation planning under water shortage.
   Onta, P. R., Loof, R., and Banskota, M.
   NAL Call #: TC801.I66


42. Performance indicators for irrigation and drainage.
   Bos, M. G.
   NAL Call #: TC801.I66


43. Performance measure for improving irrigation management.
   Oad, R. and Sampath, R. K.
   NAL Call #: TC801.I66


44. Planning simulation model of irrigation district.
   Chavez Morales, J., Marino, M. A., and Holzapfel, E. A.
Descriptive: irrigation-water, water-use, water allocation, irrigation-requirements, reservoirs, planning, simulation-models, Mexico, cropping-patterns.

45. The potential for water market efficiency when instream flows have value.
Griffin, R. C. and Hsu, S. H.
NAL Call #: 280.8-J822

Descriptors: water allocation, markets, water-use, efficiency, stream-flow, mathematical-models, demand, right-of-access.
Abstract: Most of the effort being expended to revise western water policy concerns the maintenance of instream waters to the exclusion of traditional diversionary interests. Absent from the economics literature is a theoretical treatment addressing the interface between diversionary and instream water uses. At issue is the potential for refining market operations to accomplish efficient allocation in the presence of both diversionary and instream uses. Optimization methods are employed to examine this issue in a highly generalized framework. If a specific structure is adopted, markets and other incentive-based policies are demonstrated to be capable of efficient water allocation.

46. Problems concerning solution of water supply in water-deficient areas in China.
Song, X.
NAL Call #: TD201.W346

Descriptors: water-resources, water-management, water-use, watershed-management, water-allocation, China.

47. Proposal for equitable water allocation for rotational irrigation in Pakistan.
Latif, M. and Sarwar, S.
NAL Call #: TC801.I66

Descriptors: irrigation-water, water allocation, water-systems, mathematical-models, Pakistan.

48. Real-time water allocation for irrigation.
Hannan, T. C. and Coals, V. A.
NAL Call #: TD420.W374

Descriptors: irrigation-scheduling, irrigation-requirements, linear-programming, water allocation, irrigated-farming, computer-software, Lombok.
Abstract: Throughout the world the importance of water management is becoming more
important as the demand for water increases. As one of the major uses of water, irrigation could benefit from improved management practices. The establishment of a Water Operations Centre in Indonesia has seen the development of a real-time water allocation model for a complex irrigation system covering 60000 ha. The model uses linear programming (an optimization technique) to determine the best way in which to allocate limited water supplies while keeping crop yield losses to a minimum.

49. **Regional cooperation in the use of irrigation water: efficiency and income distribution.**
   Yaron, D. and Ratner, A.
   NAL Call #: HD1401.A47

   **Descriptors:** irrigation-water, water-use, salinity, water allocation, water-quality, income-distribution, agricultural-regions, linear-models, efficiency, Israel.

   **Abstract:** The paper presents an analysis of the economic potential of regional cooperation in water use in irrigation under conditions characterized by a general trend of increasing salinity. Income maximizing solutions for the region are derived and the related income distribution schemes are solved for, with the aid of cooperative game theory algorithms and shadow cost pricing. Distinction is made between distribution policies with and without side payments. The reasonableness and the acceptability of these schemes is later critically evaluated. The Nash-Harsanyi approach seems to be the most appropriate for the conditions studied.

50. **Rent seeking, wealth transfers and water rights: the Hawaii case.**
    Bowen, R. L., Moncur, J. E. T., and Pollock, R. L.
    NAL Call #: HC79.E5N3

    **Descriptors:** groundwater, water allocation, rent, water-use, right-of-access, value-theory, property-transfers, private-ownership, water-costs, water-supply, demand, urban-areas, case-studies, Hawaii, economic-rents, willingness-to-pay, willingness-to-accept.

51. **The role of economic instruments to resolve water quantity problems.**
    Adamowicz, W. L. and Horbulyk, T. M.
    NAL Call #: 281.8-C16

    **Descriptors:** water-supply, water-policy, economic-policy, water-costs, water allocation, case-studies, water-use, irrigation, Alberta.

52. **Rural-to-urban water transfers: measuring direct foregone benefits of irrigation water under uncertain water supplies.**
    Taylor, R. G. and Young, R. A.
    NAL Call #: HD1750.W4
Descriptors: irrigation-water, water-use, water allocation, rural-urban-relations, agricultural-regions, water-supply, assessment, uncertainty, rain, stochastic-programming, opportunity-costs, crop-production, decision-making, production-functions, constraints, case-studies, Colorado, discrete-sequential-stochastic-programming, foregone-economic-value, colorado-canal, Crowley-county, colorado, soil-productivity, precipitation-constraints.

53. A simulation of water allocation policies in times of water shortage.
Burton, M. A.
Irrig drain syst. 8: 2 pp. 61-81. (1994).
NAL Call #: TC801.I66

Descriptors: water allocation, irrigation, irrigation-requirements, computer-simulation, simulation-models, drought, irrigated-farming.

54. The social context of perceived drought vulnerability.
Keenan, S. P. and Krannich, R. S.
NAL Call #: 281.28-R88

Descriptors: drought, water-use, water allocation, social-structure occupations, farm-size, farm-workers, household-surveys, California, kern-county California, san-joaquin-valley California.
Abstract: This paper examines perceptions of drought vulnerability among residents of the southern San Joaquin Valley portion of Kern County, California. The area is unique in the western United States because of its complex water delivery infrastructure and its intensive level of agricultural production supported by agricultural labor. The area is interesting to rural sociologists because it was part of Goldschmidt's research on the social implications of agribusiness. We argue that the relationship between resource production and social stratification suggested by Goldschmidt's research presents some important implications for understanding perceptions of resource scarcity in the present day. We explore perceptions of drought vulnerability by several dimensions of stratification--primary occupation, location of residence, length of residence, household income, and racial/ethnic background. While our findings illustrate that agricultural owners/operators perceive the greatest levels of concern about severe drought, the unique character of agricultural production in the area is related to perceptions of vulnerability among broader segments of the local population. The findings suggest that dependence upon existing water utilization patterns may present substantial obstacles to effective drought policy and planning.

55. Solving California's water problems is big business.
Thompson, W.
NAL Call #: SB379.A9A9

Descriptors: water-supply, water allocation, water-policy, public-agencies, California.
56. Statewide water allocation: changing attitudes.
   Potter, R.
   NAL Call #: 500-So8

   *Descriptors:* water allocation, water-resources, water-storage costs, problem-analysis, California.

57. Transferable water entitlements which satisfy heterogeneous risk preferences.
   Alaouze, C. M.
   NAL Call #: 281.8-AU74

   *Descriptors:* irrigation-water, right-of-access, property-transfers, water allocation, risk, water-costs, reservoirs, seasonal-fluctuations, probability-analysis, victoria, new-south-wales, portfolio-of-irrigation-water-entitlements.

58. Up the creek? Growers' water woes won't dry up.
   Hall, R. D.
   NAL Call #: SB379.A9A9


59. The uses of the practicably irrigable acreage standard in the quantification of reserved water rights.
   Franks, M. C.
   NAL Call #: HC79.E5N3

   *Descriptors:* american-indians, federal-government, water-use, water allocation, legal-rights, water-policy, courts, decision-making, history, feasibility, standards, quantity-controls, USA, Wyoming.

60. Value of moving from central planning to a market system: lessons from the Israeli water sector.
   Becker, N.
   NAL Call #: HD1401.A47

   *Descriptors:* water-resources, water-policy, water allocation, agricultural-sector markets, water-costs, linear-programming, mathematical-models, shadow-prices, right-of-access, institution-building, Israel.

   *Abstract:* This paper explores the implications of the transformation of the system of
water resources allocation to the agricultural sector in Israel from a one in which allotments are allocated to the different users without any permission to trade with water rights. A mathematical planning model is used for the entire Israeli agricultural sector, in which an 'optimal' allocation of the water resources is found and compared to the existing one. The results of the model are used in order to gain insight into the shadow price of the different water bodies in Israel (about eight). These prices can then be used to grant property rights to the water users themselves in order to guarantee rational behavior of water use, since now one can sell their rights at the source itself. The implication is clear with regard to any possible movement towards a market system in any other sector. From the dual prices of the primal problem we can forecast the equilibrium prices and their implications for the different users. The central government does not have to interfere with the market mechanism because, as will be shown, every farmer has the option to sell his right or to use it. As participation in the market is voluntary, every farmer makes a decision that is both individually and socially rational. However, in moving from a central planning allocation to a market mechanism, the government has another task, which is to grant the property rights in order for the market to begin to evolve. It is not guaranteed that under any initial allocation a decentralization of the system will benefit all the regions but at least part of the problem is to be resolved between the regions themselves. As the results show, there is a potential budgetary benefit of 28 million dollars when capital cost is not included and 64 million dollars when they are included.

61. **Water allocation by markets, common property and capacity sharing: companions or competitors.**
Dudley, N. J.
NAL Call #: HC79.E5N3

*Descriptors*: surface-water, water-resources, water allocation, water-supply, western-states-of-usa.

62. **Water and land as quantity-rationed inputs in California agriculture: empirical tests and water policy implications.**
Moore, M. R. and Dinar, A.
NAL Call #: 282.8-J82


63. **Water banking in Idaho.**
Mink, L. L.
NAL Call #: aSD11.A42
64. **Water for California agriculture: lessons from the drought and new water market reform.**
   Zilberman, D., Sunding, D., Howitt, R., Dinar, A., and MacDougall, N.
   NAL Call #: HD1751.C45

Descriptors: water allocation, drought, water-policy, irrigation-water, water-use, efficiency, California.

65. **Water management: a regional perspective.**
   NAL Call #: AS911.L6A3

Descriptors: water-resources, water-management, water allocation, Minnesota, Washington, Nebraska, Michigan.

66. **Water markets and water quality.**
   Weinberg, M., Kling, C. L., and Wilen, J. E.
   NAL Call #: 280.8-J822

Descriptors: water-quality, irrigation-water, markets, water-use, efficiency, water allocation, farm-management, decision-making, drainage, simulation-models, water-policy, USA.

Abstract: In addition to improving the allocative efficiency of water use, water markets may reduce irrigation-related water quality problems. This potential benefit is examined with a nonlinear programming model developed to simulate agricultural decision-making in a drainage problem area in California's San Joaquin Valley. Results indicate that a 30% drainage goal is achievable through improvements in irrigation practices and changes in cropping patterns induced by a water market. Although water markets will not generally achieve a least-cost solution, they may be a practical alternative to economically efficient, but informationally intensive, environmental policies such as Pigouvian taxes.

67. **Water policy for efficient agricultural diversification: market-based approaches.**
   Rosegrant, M. W., Schleyer, R. G., and Yadav, S. N.
   NAL Call #: HD9000.1.F66

Descriptors: irrigation, irrigation-systems, water allocation, water-use, efficiency incentives, diversification, technology, opportunity-costs, water-policy, legal-rights, Chile, Mexico, California, tradable-water-rights.

Abstract: The rapid liberalization of developing economies encourages agricultural diversification and commercialization. Prevailing water allocation methods have tended
to limit the flexibility of farmers in reallocating resources in response to changing incentives. Reform of water allocation mechanisms has lagged behind other input sectors, largely because the physical, technological and economic characteristics of water resources pose special problems to establishment of water rights and market-based allocation of water. This paper shows that there is considerable evidence of sufficient physical flexibility in most irrigation systems to permit crop diversification; that water allocation and crop planting choices respond to the scarcity value of water; and that markets in tradable water rights can be effectively implemented with appropriate design of water law, institutions, and regulations.

68. Water resources for urban areas in Maharashtra State.
Armal, S. D.
NAL Call #: TD201.W346

*Descriptors*: water-resources, urban-areas, water-management, water allocation, water-policy, Maharashtra.

69. Water resources planning in a federation of states: equity versus efficiency.
Howe, C. W.
*Nat-resour-j*. Albuquerque, University of New Mexico School of Law. Winter 1996. v. 36 (1) p. 29-36.
NAL Call #: HC79.E5N3

*Descriptors*: water-resources, resource-management, use-efficiency, water-costs, cost-benefit-analysis, water allocation, opportunity-costs, pareto-efficiency.

70. Who should get the water? Decision support for water resource management.
Chapman, R. A., Manders, P. T., Scholes, R. J., and Bosch, J. M.
NAL Call #: TD420.A1P7-v.32,-no.5-6

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