



2022

#54

E5

Indigenous Knowledge and Traditional Yemeni Irrigation

Daniel Martin Varisco

First published in *Indigenous Knowledge and Sustainable Agriculture in Yemen, Les Cahiers du CEFAS, 3*, edited by Amin al-Hakimi and Frédéric Pelat (Sanaa: Centre Français d'Archéologie et de Sciences Sociales de Sanaa, 2003) Updated 2022.

Yemen's agriculture has flourished for over three thousand years because of the variety of ways in which limited water resources have been used for irrigation and water supply. The history of Yemeni irrigation, which has yet to be surveyed systematically, is not only a measure of the rich cultural heritage of its people but also a vital source for planning sustainable development of Yemen's agriculture in the face of rapidly diminishing water resources. The message of my talk today is that sustainable development must build on this existing knowledge of generations of Yemeni farmers. We should not assume that new and imported methods and technology can be transplanted to Yemen in a vacuum. We need to document the indigenous Yemeni knowledge and practice in irrigation, whether through ethnography or historical analysis, in order to assure that Yemen will continue to be a verdant Yemen (al-Yaman al-Khadra').

I view my purpose here today less as an outside expert describing traditional Yemeni irrigation than an advocate for including indigenous Yemeni knowledge of irrigation as a necessary component of sustainable development planning. After a brief personal introduction, I will describe the relatively recent theoretical shift toward sustainable development that includes indigenous knowledge as a priority. Following this, I will give some specific examples of the relevance of such knowledge for Yemen's development and conclude with an outline for the kind of information that should be collected and analyzed.

My introduction to Yemeni irrigation began in early 1978, when I started a year-long ethnographic field study in the highland valley of al-Ahjur, to the west of the Kawkabān plateau. The numerous springs (*ghayl/ghuyūl*) of Ahjur provide a case study of a functioning springfed irrigation system with secondary collection in cisterns and customary allocation of water shares in a gravity-flow channel network. My analysis of the cultural ecology of Ahjur's spring irrigation, including the traditional allocation of rights to land and water, was written in a Ph.D. dissertation in 1982, and several subsequent journal articles. Following this I began intensive study of medieval Yemeni texts on agriculture and folk astronomy, most notably an edition and translation of the 13th century almanac of the Rasulid al-Malik al-Ashraf. During the 1980s and early 1990s I consulted in Yemen's development, primarily agriculture and environmental impact analysis, for USAID and the World Bank. My work, as you can see, extends from the history of Yemen's agriculture through contemporary practices to ongoing and future development.

Indigenous Knowledge and Sustainable Development

Allow me to begin with an anecdote regarding what I see as the opposite of "sustainable development." My first consulting job in Yemen was as one of three Arabic-speaking members (the only one with previous experience in Yemen) of a ten-man team sent to Yemen in 1981 to

conduct a whirlwind, 3-week “Agricultural Assessment” of Yemen. The resulting document, which you can probably find buried in the ministry library, is largely a rehash of economic data taken out of context with virtually nothing on agriculture as it is actually practiced in Yemen. This was a top-down, highly political exercise; the report was put together mainly by experts who saw development solely as bringing in new technology, new seeds and new crops, and “Western” ideas of corporate, mechanized farming. If the same funding -- several hundred thousand dollars -- had been used to document indigenous Yemeni agricultural and irrigation practices at the time, we would now have a base of relevant data to build the future of agriculture relevant to the ecology, economy and social context of Yemen today.

I need to define some terms first. The concept “indigenous knowledge” has finally arrived in development planning. This refers to local knowledge specific to people who learn from the experience of previous generations and is generally passed on orally in modified form to the next generations. Such knowledge often represents successful adaptation to the local environment. In other words, what works well gets passed on along with new ideas and improvements. In the specific case of irrigation, this might include knowledge of seasonal water availability, local soil and terrain conditions, efficient means of water diversion and application, and appropriate timing for optimal plant growth. This knowledge is difficult to analyze in the formal models of economics or modern agronomy, since it has evolved within the restrictions and cultural uniqueness of the local society and ecological framework. Because such knowledge is not considered “scientific” and is rarely documented, it has been easily overlooked, even dismissed as irrelevant, by development planners .

The importance of indigenous knowledge did not take hold in the development community until the 1990s. It is worth remembering that the UN Conference on Environment and Development in Rio de Janeiro in 1992 called for “recognition of their [indigenous] values, traditional knowledge and resource management practices with a view to promoting environmentally sound and sustainable development” (Agenda 21). This interest in indigenous knowledge came about in part due to efforts of social scientists such as Dennis Warren, who in 1987 helped found the Center for Indigenous Knowledge for Agriculture and Rural Development at Iowa State University. Beginning in 1993 the Indigenous Knowledge and Development Monitor, published in The Netherlands, has been a major stimulus for applying research on indigenous knowledge to development planning. Regional and national centers devoted to indigenous knowledge in development have sprung up around the world in the 90s. Recent seminars and publications from UNDP, the World Bank and bilateral donors such as USAID now address the relevance of such knowledge for sustainable development.

It is important to understand why this has happened. Twenty years ago the dominant paradigm for agricultural development still promoted advanced technology and a Western mode of economic efficiency as a universal formula. Even then it was becoming clear that technology transfer -- specifically the local acceptance of new technology along with its proper use and long-term economic costs -- was not simply a matter of giving a farmer a new tractor and telling him to celebrate by roasting his ox. Little attention was paid to what kind of technology was appropriate in developing countries and the usefulness of existing technology and practices that already worked. In fact, the commercial motive to sell Western machinery to the Third World

outweighed a concern for what people actually needed. A major problem is that there has seldom been accountability for failed projects, since development personnel usually spend only a short time in Yemen. It is not hard to see how millions of aid dollars and mega-hours of expert manpower resulted in very little that was sustainable.

At the same time an insidious by-product of “modernization” was the message that traditional ways of doing agriculture were backward, inefficient and a hindrance to development. Some of the experts I knew who came to Yemen arrogantly tried to reproduce methods used in Western economies which had an educated and economically well-off population. Ironically, these textbook recommendations for developing countries involved methods that even at that time were proving not to be sustainable in America and Europe. I say this was insidious because young Yemeni professionals, largely trained in Western universities, understandably wanted the best technology and methods for their own country. The problem that few people saw at the time was how existing policies and programs did not promote sustainable development. Much money was wasted while many sustainable practices were being lost.

Sustainable Agriculture in Yemen’s History

The recent push for sustainable development is as much the result of policies that have failed miserably as it is an academically sound approach to development planning. The number of problems that have limited agricultural development -- and these are hardly unique to Yemen -- is extensive: much of the advice given by international donors comes from “experts” who really know very little about Yemen; most of the economic projections for agricultural projects have been wrong; introduced technology may not be appropriate or affordable over time; most projects encourage or tolerate over-use of water rather than conservation; global economic and political policies prevent growth of effective local markets. I am not so foolish as to argue that such problems are only of recent vintage and due solely to outside interference. The history of Yemen’s agriculture -- especially the various irrigation and water harvesting systems that evolved over centuries -- has had its ups and downs. My point is that much of the surviving indigenous farmer knowledge preserves what led to the “ups”. In other words, by examining the knowledge that has survived in oral tradition we have an opportunity to see what has generally proved to be sustainable in the past and into the present.

It is now time to be specific. What can we learn from indigenous irrigation systems in Yemen? For this I will mention three kinds of examples to stimulate discussion. I divide my examples into practices, principles and processes. In Ahjur, as an example, local irrigators have specific ideas on when to irrigate (depending on the time of day and season, as well as the state of the crop to be irrigated), how much water to apply (depending on soil and plant conditions), and which plots have greater needs than others. These practices are not arbitrary, but rather the result of community-based trial and error in local field systems over centuries. While you cannot adopt a local practice wholesale in another context, the observations that led to the local allocation cycle can be learned from. Some practices may have practical application across Yemen. For example, farmers in the Hadramawt were observed -- in a project I led in 1992 on indigenous plant protection practices -- to place cut-up stalks of *Calotropis procera* (*‘ushār*) in

irrigation channels in order to help ward off several local insects from the irrigated crops. Here is a specific case where ethnographic documentation and scientific investigation can work hand in hand to possibly identify a readily available natural plant as a cheap alternative to use of imported and environmentally damaging pesticides.

A second kind of lesson to be learned from Yemen's indigenous irrigation involves principles, especially long-standing approaches to resource use and conservation. Two such principles that I saw at work in Ahjur are Islamic precepts that all Muslims share in water as a resource and that water as a resource cannot be individually owned. The first is clear from a well-known hadith based on the belief that Allah is the owner since he provides the water, whether from rain, rivers or springs. Islamic water law, which has been well documented by Dr. Abdulla Maktari in his case study of Lahj, evolved guarantees of the individual to drinking water and communities to the water needed for their survival and production. My purpose here is not to go into the elaborate details of the law, but to note that in practice Yemeni society has gone to great lengths to provide drinking water -- for man and beast -- and to share this limited resource. The Prophet also said that whoever holds on to surplus water when another needs it will find Allah holding back his mercy on the Day of Judgment. Political disputes over water have always been around, but when these principles were adhered to, they promoted sustainable development in Yemen long before it was discovered by the experts.

My final set of examples relates to process. Anthropologists who study irrigation often focus on the ways in which inevitable disputes over water allocation are mitigated or resolved. In many parts of the world irrigation development has meant a dramatic shift from local community control to directed control by outside governmental agencies. My interest is not in debating the merits of centralized resource management, but rather to see what we can learn from customary processes by which Yemeni communities resolve resource allocation problems. My own focus twenty years ago was on the relation between tribal customary practice and Islamic law. I discovered that by and large there was little conflict between these on issues of resource allocation -- unlike the disagreement over social issues like marriage and inheritance. Maktari's study of fatwa decisions, for example, shows that unless there is blatant violation of Islamic principles, jurists in the past rarely objected to local customs of allocation. In my own fieldwork in Ahjur a local shaykh once explained that the opposite of customary law (*ahkām al-aslāf*) was not Islamic law but rather recently created governmental law (*ahkām al-akhlāq*). My point is that an allocation process that takes into account current customary practice will affect greater positive change than a system imposed by a bureaucrat with no knowledge of the local community.

Integrating Indigenous Knowledge in Yemen's Irrigation Development

Irrigation is a technique, not an end in itself. Developing irrigation systems must be accomplished as part of a resource use strategy that balances production needs, water supply needs and environmental stability. This delicate balance has not remained the same over Yemen's history; nor should we argue that existing methods should be preserved simply because

they have worked in the past. The most important need now is careful and thorough documentation of Yemen's indigenous irrigation practices. How can this be done?

The collection and study of what is called "indigenous knowledge" in development are unlike the economic and technical approaches used in the sciences and a majority of the social sciences. For example, if you are trained as an irrigation specialist in an engineering program, you will look at the kinds of material and technical data relevant to solving engineering problems: this will include water flow, sediment load, soil conditions, physical means of diverting or storing water, channel networks, and the like. If you are an economist looking at development of an irrigation farming systems, you will focus mostly on statistics, even if some of these are obtained from irrigators themselves. Ideally, the social aspects of irrigation will be studied by a trained anthropologist or sociologist. As an anthropologist, let me assure you that documenting social conditions is every bit as specialized as the work of an engineer or economist. Now, in practice you would never ask a sociologist (with no scientific training) to go into the field and study the technical engineering aspects of a water-transport system, because it is assumed -- and rightly so -- that a certain level of technical training and experience is needed. Yet, it is not uncommon on development projects, even in Yemen, to let the economist collect the social data or to hire someone with general training in the social sciences but who does not even speak Arabic.

The first obstacle in designing projects to collect indigenous knowledge is to overcome what I call the obstacle of scientific arrogance. The kind of work that engineers and economists do requires specialized training because it is not a part of most people's everyday experience. However, collecting information about household size, marriage patterns, cultural values and customary practice is often not seen as intrinsically difficult or requiring specialized training because we all grew up in households, had parents, learned cultural values and did all kinds of things without knowing why we did in a formal way. The assumption in development planning has been that the technical and economic factors would determine the success of a project. In reality, the unplanned and highly variable flow of everyday social life can greatly alter the best laid plans on paper. I use the term "arrogance" for this obstacle, because there is a twofold assumption that what formally untrained, i.e. traditional, farmers do is backward and out-of-date and that social variables are unimportant as long as the technology and the cost-benefit analysis point to success. The reason this approach has been so disastrous worldwide is that real people, not ideal households or statistical means, actually use and misuse irrigation systems.

I suggest three principles for designing the collection of indigenous irrigation knowledge in Yemen. First, following on my remarks above, it must be recognized that collecting indigenous knowledge requires the proper training in qualitative as well as quantitative ethnographic techniques. I speak here as an ethnographer, because a major part of such study is to find what is relevant in the largely undifferentiated flow of daily life. The engineer not only knows what is relevant but can easily find it in the field; the ethnographer has an idea of what should be there but relevant information may not be readily apparent and its collection requires working in cooperation with human subjects.

A second principle relates to the efficiency of collecting, even knowing what to collect, in the field. Indigenous knowledge is primarily, though not exclusively in the case of Yemen, oral.

Much of it is lost in the normal flow of events; some people have better understanding than others; it is not always easy to distinguish between practices and ideas that are viable and those that appear to be superstitious or just plain “folklore.” Thus, obtaining this information requires extensive interaction with farmers -- not a whirlwind household survey -- by someone who not only has a range of communication skills, but also someone who is fluent in the local language. Sending in a trained sociologist or anthropologist who cannot speak directly with farmers will accomplish little of value. The information will be fragmented and probably misleading, even if an interpreter is provided. It is also true that being fluent in Arabic does not guarantee effective communication in the field. I realize that there are not a lot of experts who fit these requirements, which is why emphasis needs to be placed on training Yemeni students in programs of development anthropology or rural sociology just as they are trained as engineers and economists. All are needed if development is to be sustainable.

Third, in the case of Yemen there exists a preliminary data-base on indigenous irrigation and agricultural practices in historical documents, such as several major agricultural texts from the Rasulid period, numerous short treatises and almanacs, and even in poetry. Let me give you a specific example from my own work. In reading the 13th century agriculture book by al-Malik al-Ashraf, I noticed a discussion on a local problem in the Tihama with the date-palm moth larvae feeding on the inflorescence (*tal'*) of dates. The remedy, mentioned in the text, was to take a variety of highland ant (called *qa's*) and put these as colonies in the date trees. During a project with the Plant Protection Unit of the ministry in 1992 my team found an old farmer in Zabīd who had been doing exactly this until recently. This form of biological control, using a local species with a long history of use, is precisely the kind of sustainable farmer knowledge that should be studied for its scientific merit and promoted for its sustainable impact. In this case, not only is it cheaper and safer than using imported pesticides, this kind of biological control is cutting-edge in Western research on plant protection. And, I wish to add, a Yemeni contribution to Yemen's development.

In very brief conclusion, I encourage ministry officials, faculty of Yemen's universities and agricultural colleges and development personnel to develop a program for collecting and analyzing indigenous farmer knowledge before we are forced to call it extinct farmer knowledge. Sustainable irrigation in Yemen should benefit from appropriate scientific and technological inputs from abroad, but these must be -- if I may use an agricultural metaphor -- “grafted” onto the base of Yemen's own traditional practices. I applaud this conference as a step in this long overdue process.

Suggested Readings

al-‘Ansī, Yaḥyā ibn Yaḥyā

2008 *al-Turāth al-zirā'ī wa-ma'ārifih fī al-Yaman*. Ṣan‘ā': al-Hay'a al-‘Āmma li-al-Kitāb. Two volumes.

2006 *al-Mawāqīt al-zirā'īya fī aqwāl 'Alī ibn Zāyid wa-al-Ḥamīd ibn Mansūr wa-ākhirīn*. Second Edition. Ṣan‘ā': Maktaba al-Irshād.

1998. *al-Ma‘ālim al-zirā‘īya fī al-Yaman*. Ṣan‘ā’: al-Markaz al-Fransī li-al-Dirāsāt al-Yamanīya and al-Ma‘had al-Amrīkī li-al-Dirāsāt al-Yamanīya.

Donaldson, William J.

2000 *Sharecropping in the Yemen: A Study in Islamic Theory, Custom and Pragmatism*. Leiden: Brill.

Eger, Helmut

1987 *Runoff Agriculture. A Case Study about the Yemeni Highlands*. Wiesbaden: Dr. Ludwig Reichert Verlag.

Gingrich, Andre

1994 *Südwestarabische Sternkalender: Eine ethnologische Studie zu Struktur, Kontext und regionalem Vergleich des tribalen Agrarkalenders der Munebbih im Jemen*. Wiener Beiträge zur Ethnologie und Anthropologie, 7. Vienna: Institut für Völkerkunde.

Gingrich, Andre and Johann Heiss

1986a A Note on Traditional Agricultural Tools in Ṣa‘dah Province (with Special Reference to the Ard). *Proceedings of the Seminar for Arabian Studies* 16:51-63.

1986b *Beiträge zur Ethnographie der Provinz Ṣa‘da (Nordjemen)*. Sitzungsberichte Öster. Akad. d. Wissenschafte, Philo-histor. Klasse, Band 462.

Kopp, Horst

1987 Agriculture in Yemen. From Mocca to Qāt. In Werner Daum, editor, *Yemen: 3000 Years of Art and Civilization in Arabia Felix*, 368-371. Innsbruck: Pinguin-Verlag and Fankfurt: Umschau-Verlag.

1981 *Agrargeographie der Arabischen Republik Jemen*. Erlanden: Erlanger Geographische Arbeiten, Sonderband 11.

Lichtenthäler, Gerhard

2000 Power, Politics and Patronage: Adaptation of Water Rights among Yemen’s Northern Highland Tribes. *Études rurales* 155/156:143-166.

Maktari, Abdulla

1971 *Water Rights and Irrigation Practices in Lahj*. Cambridge: Cambridge University Press.

Maraqten, Mohammed

2017 Typology of Irrigation Systems in Ancient Yemen in the Light of the Epigraphic Evidence. In Walid Yasin Al Tikriti and Paul Alan Yule, editors, *Proceedings of Water & Life in Arabia Conference*, 115-135. Abu Dhabi: Abu Dhabi Tourism and Culture Authority.

Serjeant, R. B.

- 1988 Observations on Irrigation in South West Arabia. *Proceedings of the Seminar for Arabian Studies* 18:145-153.
1974. The Cultivation of Cereals in Medieval Yemen. *Arabian Studies* 1:25-74.
- 1964 Some Irrigation Systems in Ḥaḍramawt. *Bulletin of the School of Oriental and African Studies* 27:33-76.
- 1954 Star-Calendar and an Almanac from South-West Arabia. *Anthropos* 49(3/4):433-459.
- Serjeant, R. B. and Ḥusayn ‘Abdullah al-‘Amrī
- 1981 A Yemeni Agricultural Poem. In Wadad al-Qadi, editor, *Studio Arabica et Islamica*, 407-427, Beirut: AUB.
- Tutwiler, Richard N. and Sheila Carapico
- 1981 *Yemeni Agriculture and Economic Change*. Ṣan‘ā’: American Institute for Yemeni Studies.
- Varisco, Daniel Martin
- 2017 *Date Palm Production in Rasulid Yemen*. Ulrich Haarmann Memorial Lecture. Berlin EB Verlag.
- 2015 *Pars Pro Toto* Observation: Historical Anthropology in the Textual Field of Rasulid Yemen. *History and Anthropology* 26(1):92-109.
- 2009 Agriculture in al-Ḥamdānī’s Yemen: A Survey from Early Islamic Geographical Texts. *Journal of the Economic and Social History of the Orient* 52(3):382-412.
- 2007 Turning Over a New Leaf: The Impact of *Qāt* (*Catha edulis*) in Yemeni Horticulture. In Michel Conan and W. John Kress, editors, *Botanical Progress, Horticultural Innovations and Cultural Changes*, 239-256. Washington, DC: Dumbarton Oaks Research Library and Collection.
- 2002 Agriculture in Rasulid Zabīd. *Journal of Semitic Studies*, Supplement 14. *Studies on Arabia in Honour of Professor G. Rex Smith*, edited by J. F. Healey and V. Porter, 323-351. Oxford: Oxford University Press.
- 1996 Water Sources and Traditional Irrigation in Yemen. *New Arabian Studies* 3:238-257.
- 1995 Indigenous Plant Protection Methods in Yemen. *Geojournal* 37:27-28.
- 1994 *Medieval Agriculture and Islamic Science: The Almanac of a Yemeni Sultan*. Seattle: University of Washington Press.
- 1993 The Agricultural Marker Stars in Yemeni Folklore. *Asian Folklore Studies* 52(1):119-142.
- 1992 The Future of Terrace Farming in North Yemen: A Development Dilemma. *Agriculture and Human Values* (Gainesville, FL) 8(1&2):166-172.
- 1989c Land Use and Agricultural Development in the Yemen Arab Republic. In M. Salem Murdock and M. Horowitz, editors, *Anthropology and Development in North Africa and the Middle East*, 292-311. Boulder: Westview Press.

- 1985a The Production of Sorghum (Dhurah) in Highland Yemen. *Arabian Studies* 7:53-88.
- 1985b al-Tawqī'āt al-zirā'īya wa-al-'ilmīya bi-al-taqwīm al-majhūl min 'aṣr Banī Rasūl. *Dirāsāt Yamanīya* (Ṣan'ā'), 20:192-222.
- 1983 Sayl and Ghayl: The Ecology of Water Allocation in Yemen. *Human Ecology* 11:365-383.
- 1982 The Ard in Highland Yemeni Agriculture. *Tools and Tillage* 4:158-172.