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ABIDETH FOREVER?
GLOBAL USE OF SEMIARID LANDS IN THE INTERWAR YEARS

J. M. POWELL

I have undertaken a highly selective Cook’s Tour in this article, attempting to integrate our understanding of semiarid lands around the globe. The focus is concentrated on the period between the two great wars when new nationalisms, old imperial networks, and the burgeoning ambitions of scientists combined to create new systems of land use in the semiarid regions, but a few sorties have been made into earlier and later periods to assist the interpretation of specific projects. My own country, Australia, is used as the starting point for the tour, but the influence of American Donald Worster’s Dust Bowl (1979) will be easily discerned. I have argued that the environmental and economic crises around the world in the interwar years were to some extent culturally induced and that they were linked by similar assumptions, crossing cultural and economic lines, about the potential and rationale for settlement in semiarid lands. Heavy investment in science and technology, multiple ways to manage risk and indebtedness, and expansions of the scale of Western-style capitalistic farming in semiarid areas were typical of capitalist economies, but consideration is also given to developments in semiarid regions characterized by communist and mixed economies.

The whirlwind nature of my tour has forced the exclusion of some details and ambiguities: I have asked, instead, if decisions about the management of these many different regions were developed within the region as a result of experience or outside the region in response to planners’ hopes for the society as a whole. Thus a nationalist or imperialist rhetoric is counterposed to the empirical findings of scientists and settlers committed to a particular place and personally witness to the stringencies of a particular semiarid environment. Symbolic of cultural determinism, implicit in the following interpretations, is the case of Griffith Taylor, the founding father of academic geography in Australia. His writings on environmental limitations to settlement and agricultural production were angrily banned.

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[GPQ 6 (Summer 1986): 151–170.]
by boosters who preferred to believe, with Arctic explorer Vilhjalmur Stefansson, that “the worthlessness of any large territory is imaginary... Such a territory is worthless simply because people insist on thinking it so” (Powell 1980).

Let me set the scene. First, there were extensive semiarid plains in both hemispheres—the grasslands, pampas, prairies, savannas, steppes, and the great alluvial or “riverine” plains. During the period between the world wars, the influential sections of some communities were obsessed with Lebensraum, ecumene, and national self-sufficiency, and they considered the plains environments relatively underused. Second, there were quantum leaps in scientific and technological information in the early twentieth century, and the efforts of some individuals and groups to coordinate and synthesize these developments were distinctive characteristics of the interwar years. The scientists’ hopes for accelerated social reform and economic development found appropriate tasks on the semiarid frontiers. Third, in China and in the U.S.S.R. science was to be harnessed to revolutionary change as the peasant modes of settlement were replaced by collectives and state farms. Semiarid country was again prominently in focus. Fourth, though historians have argued that peasant cultivators and herders in the communist world paid the highest price for changes during this period, heavy costs were also levied on the semiarid plains of advanced, developing, and less developed countries within the Western sphere of influence.

FIG. 1. Simplified average annual rainfall map for Australia, showing state boundaries and capital cities.
RANCHERS AND NOMADS: AUSTRALIA

Leading a decrepit one-eyed horse, a lonely boy scarcely into his teens moved quietly out of his Adelaide home. His destination was the Barrier Range in the Corner Country of New South Wales—specifically, the Poolamacca Station, where his brother George lived. George found him dubious employment with a landless bushman who lived close to nature and beyond the law, moving his stock around the unfenced properties on that wide frontier. The youth learned other bush skills from his native companions and over the years his involvement in carting, coaching, droving, and meat supply made him widely known in isolated mining and grazing communities. By the time he was thirty years old, his coaching business covered western New South Wales and parts of Western Australia; he was supplying his own horses to this trade and was beginning to provide remounts for the British Army in India. By the outbreak of the Great War his business had survived droughts and depressions and floods, and he controlled numerous farms and stations, mainly cattle country, that exceeded in area the whole of England.

The boy was Sidney Kidman (1857-1935), the future "cattle king." The supremely independent, opportunistic Kidman conceived a brilliant management strategy in response to the outback challenge—he developed great chains of carefully located properties reaching from the remotest northwestern corner of Australia to the Flinders Ranges, in striking distance of the Adelaide market. An oblique line directly drawn some two thousand kilometers across the continent gives some impression of the scale of operations: Kidman linked his interests in the monsoonal country bordering the Gulf of Carpentaria with others in the backcountry of western Queensland and New South Wales, thereby picking up the chances offered by occasional southerly flows in the Georgina and Diamantina rivers, and down the Coopers Creek district into South Australia. It was an aggressive stroke, seemingly an uninhibited application of the lessons of the nomads' flexibility and opportunism to Kidman's own relentless search for profit. His empire included agencies in each of the capital cities and in some of the provincial towns, with any number of interlocking companies and partnerships to bamboozle the most efficient taxation inspector. In the 1930s he owned or had an interest in a huge amount of land, variously estimated at between 126,000 and 170,000 square kilometers.

In its major emphases Kidman's approach to land management was at once innovative and traditional. Although it was highly individualistic it was also built on broader conventional wisdom derived over generations of aboriginal settlement. And, despite his ultimate achievements, Kidman did not escape the hazards endemic to the inland: although the great drought of 1902 punished most of his neighbors far more severely, it nearly brought him to his knees, and his empire, though not destroyed, was broken up during the 1925-32 drought.

PROBLEMS OF TENURE

Kidman's pastoral kingdom was built on judiciously selected leaseholds. Indeed, it was the leasing principle that had provided the framework for most semiarid and arid land settlement in Australia since the middle of the nineteenth century—and that remains dominant today. These leasehold tenures have resulted from dynamic interchanges between official and popular evaluations of land in a dramatically unpredictable climate. Ownership rests ultimately in the Crown—that is, in the community at large, politically represented at federal and state levels—and the leasing arrangements declare rights and responsibilities regarding such items as the length of tenure, the size of the holding, amount of rental expected, types of enterprise and permitted stock-carrying capacities, and even a few directions relating to the required backgrounds and qualifications of leaseholders. Therefore, the leasehold is a living docu-
ment incorporating the product of official-popular interplay at any moment in fat, lean, and indifferent times.

The frontier pastoralists frequently acted in advance or in open defiance of their governments, and their pioneer adaptations helped to shape the evolving leasehold arrangements. They stocked heavily in the good seasons and generally strove to hold on to as large an area as possible in an attempt to contain the effects of localized droughts; their experience gradually enabled them to recognize the unpredictable nature of the resource base, and they were persuaded toward the commonsensical adaptation of high levels of temporal and spatial mobility. In marked contrast, until the late interwar period, the consuming concern of state and federal authorities was to intensify the occupation of all the marginal lands, and they abandoned that position with reluctance.

**How Big Is a Homestead?**

Because official viewpoints were naturally influenced by the powerful urban interests, some of the most enduring contributions to the leasehold as a structural adjustment to marginality came in the form of a wider diffusion of the “welfare state” ideal. The most telling example was the direct incorporation of the notion of “living areas” or “maintenance areas” into the land legislation of certain states. The major problem was in defining the area required to support a family unit. It was difficult enough to find agreement on an “average family” or on expectations of a reasonable “standard of living.” The selection of a reliable measuring stick was no easier. The capacity to carry a specified minimum number of stock per holding, or merely the area of the holding, variously found favor. Debates on these issues focused on the differences between experiential and theoretical understandings of the environment. Competent local and regional inventories are obviously needed and, accordingly, there has always been significant potential for the forceful presentation of popular claims confidently based on familiar statistical and other evidence. In New South Wales and Queensland the early efforts of the authorities were directed toward restricting the maximum sizes and ensuring a defined minimum area for individual pastoralists. Governments consistently argued for a progressive intensification of settlement despite uncertainties, thus by implication admitting their responsibility to settlers.

Early official definitions of homestead maintenance areas in semiarid New South Wales favored nine square miles (5,760 acres) in 1883; at the end of the century preferences oscillated between a doubling of the previous standard and a measure based on proven carrying capacities ranging from 4,000 to 8,000 sheep or sheep equivalents, depending mainly on climatic conditions. Queensland was more generous, sanctioning 20,000 acres in 1897 and increasing this to 40,000 and 60,000 acres for the drier west a few years later. Living areas in each state continued to increase. In New South Wales after 1938 the living standard of the land, as well as the people, was to be taken into account—safeguards for the preservation of soil and vegetation were written into the leasing provisions. Queensland’s 1927 Act allowed the necessity of sufficient land to offer a “reasonable reserve” or cushion during the droughts, and after World War II individuals were permitted to obtain chains of leaseholds where it could be shown that they were to be run as a risk-spreading unit taking maximum advantage of environmental diversity. Lessons learned by the pastoralists themselves usually provided most of the legislators’ cues, and adjustments to leasehold structures frequently owed something to a collective politicization of Australia’s graziers.

**Other Adjustments to the Land**

Australian graziers and government officials learned from their mistakes. They also learned from the widespread results of empirical testing or “folk experimentation” in Australia’s marginal environments, notably in the late-nineteenth century advance-retreat se-
quence of wheat farming in South Australia’s northern district beyond Goyder’s Line. However, some mistakes were repeated. In the absence of freehold rights, users may choose to continue environmentally destructive practices in search of short-term profit. Errors in official management policies may teach land users to doubt the authorities’ wisdom and to milk government agencies for part of the financial backing needed to attempt the kind of geographical diversification practiced by Kidman. Nor were the decisions always made by individuals. At various periods, companies and partnerships have been more common than individual family holdings, and of course the banks have held immense tracts from time to time.

Only the sheer immensity of his operations distinguished Sidney Kidman’s audacious strategies from thousands of more modest ones. From the middle of the nineteenth century, in grain and grazing regions alike, settlers made strenuous efforts to achieve official sanction for larger minimum areas while simultaneously maneuvering to obtain their own more viable units, even in defiance of the law, and notably in combination with family members or neighbors. The resulting mosaic of fragmented units was more characteristic than the compact blocks sketched out by the legislators.

While management of land itself progressed in a variety of legal and extra-legal fashions, management of distance was accomplished by official and private cooperation. The good economic sense of droving was not easily shaken; it remained a uniquely Australian institution, variously romanticized. In the inter-war period a myriad of “travelling stock routes” in every state guaranteed graziers public access at nominal fees. Many routes remain today, despite the recent rapid introduction of road transport, and their estimated total area of over ten million acres provides critical supplementary reserves during the droughts (McKnight 1977). In the nineteenth century, camels successfully replaced horse teams and bullocks over wide areas, and the telegraph and later the telephone and radio blissedly reduced the sense of isolation. Education by correspondence was encouraged in the early twentieth century by such technologies; even the humble bicycle brought a degree of local and regional emancipation and increased the spatial competitiveness of mobs of itinerant shearsers and other rural workers (Fitzpatrick 1980). Health care also came to the outback. Beginning in 1911, Bush Nursing Associations provided autonomous and self-contained medical care for isolated rural communities too small to support their own doctors. Similarly, the Flying Doctor Service, which is currently government-supported and registers over 100,000 consultations annually, began in 1927 as part of the Presbyterian Church’s Australian Inland Mission.

These valued Australian adjustments mainly developed in situ within a relatively advanced and homogeneous white population that is still disadvantaged by isolation (Avery et al. 1980; Lonsdale and Holmes 1981). By the 1930s the aboriginal community formed a minuscule residual, largely concentrated on outback reserves or as workers on pastoral stations. Despite their small numbers, their extraordinary skills as all round stockmen were significant in the cattle regions on the arid fringes; their co-option as underpaid workers was one of the more exploitative adaptations developed by bigger British and Australian leaseholders. At least those native people survived, after a fashion, in the dominant white society. They and their grandchildren have been pressing the case for a better deal over recent years, with such effect that they now hold far more inclusive rights over some large semi-arid areas than any whites have been able to obtain.

**Pastoralism in Asia and Africa**

Elsewhere in the world traditional pastoral nomads continued to be subjected to intrusive “modernizing” forces throughout the interwar years. For example, the peoples of Outer Mongolia, who could boast their own distinc-
tive heritage of imperial activities, had become locked between China and Russia and dependent on both. Surrounded by revolution in the only world they knew, they were soon easily conquered and effectively brought within the Soviet empire. Their active and passive resistance to the collectivization plans of Stalinist Russia weakened the ancient economic and social base, precipitating disruption that stymied planners for thirty-five years.

Western-style imperialism in Africa in the period between the world wars was even more damaging, insofar as its consequences have resonated down the years to plague today's independent African states. Stereotyped images of the pastoral Masai, for instance, were partly manufactured in the nineteenth and early twentieth centuries by competing Europeans who described them as living anachronisms—inefficient and careless users of the land who held cattle for reasons of status and were culturally resistant to the marketplace and other innovations. Such fictions and exaggerations encouraged attempts to replace their pastoral ways by more modern practices. Yet in the 1930s and 1940s the Masai successfully marketed large numbers of cattle, including scores of thousands to an enterprising meat-canning firm, and they had developed admirable social and ecological adaptations to cope with their difficult environments. Furthermore, these were enlightened, rationally based adjustments, maintaining an emphasis on mutual aid and cooperation and including strong sanctions to curb inefficient uses. Such a well-tried ethical system provided a valuable but long-neglected indigenous base for sensitive and sustained development programs.

In opposition was geographer Griffith Taylor, whose aggressive writings on climatic controls in agricultural production and more generally on the severe environmental limitations on future white settlement were by no means confined to the professional journals. Taylor had deliberately set out to debunk the boosters. For more than a decade he had exposed and ridiculed the naive promotion of “Australia Unlimited.” Using elementary resource inventories and latitudinal analogies, he predicted a total population of about nineteen or twenty million by the end of the century. Stefansson’s tour was clearly intended as a direct challenge to Taylor, who promptly
replied with a far more detailed field investigation of the inner margins of settlement around the continent. In the ensuing furor the uncompromising Taylor was widely disowned as “unpatriotic,” a “croaking pessimist,” and, ultimately, an “environmental determinist.”

The episode appears to confirm the pervasiveness of various types of colonial dependency. Australia’s “underused” capacities had been promoted in a long succession of Imperial Conferences. Above all, the Dominions Royal Commission (1912–17) had suggested a special status for Australia in a “revivified” British Empire, a strengthened union that was to be distinguished by any number of real and assumed linkages and priorities based on economic, military, political, and racial arguments. The Commission emphasized the neglected benefits of enduring sentimental ties between Britain and the old (and of course white) Dominions, and inevitably a connection was unashamedly drawn in some quarters between this notion and the supremacy of “Anglo-Saxonism.”

Resource inventories of each of the major Dominions and various imperial “possessions” were called for to determine ways of reducing the dependence on foreign suppliers. Britain was said to be crowded, overpopulated; in contrast the Dominions were indeed “empty,” and so the principle of complementary needs and aspirations seemed obvious. The inauguration of an Australian federal government in 1901 had intensified nationalism on the continent. Australians worried about their small and predominantly urban population, with a country-wide average density of scarcely more than one white inhabitant per square mile. It was said that settlement of the interior promised to increase productivity and enhance national security, and even—in terms similar to those used by Frederick Jackson Turner for the United States—contribute to the development of a distinctly Australian national character. Queensland, Western Australia, and the Northern Territory, immense and self-consciously young regions of the new Commonwealth, clamored for development. Labor unions were suspicious of immigration in general because they feared more competition among workers, but they favored settlement schemes that would build domestic markets. Expansion into new areas also decreased the need to intensify settlement in the older districts near the coasts, a demand that had put state governments at odds with their substantial landowners. All of these popular nationalist ideas were congruent with the new imperialism, and the two strains of thought combined in widespread public enthusiasm.

In opposition stood Griffith Taylor. His relentless insistence on regional or national controls might have struck a more sympathetic chord if he had balanced it with closely textured local analyses, which could not have failed to admit actual and potential human achievements. At that juncture the Australians were accustomed to local environmental evaluations, at both the public service and folk experimentation levels. That kind of specificity would have made a more promising platform for the promotion of geography in the “new” education, but Taylor chose to make his stand on “national issues” and “nation-planning.” His geography textbook on Australia was banned by Western Australian education authorities because of its embarrassing employment of the hated terms desert and aridity, yet he persisted in his declaration of a relatively modest national ecumene. Vilified on all sides, Taylor resigned his Sydney appointment in 1928 to take up a position at the University of Chicago.

**Influence of Immigration**

Another expression of imperial optimism was the Empire Settlement Act of 1922, which allowed the British government to support development programs and pioneer settlement schemes in the Dominions, facilitating emigration by paying passages and providing training and initial living allowances. Ecstatic publicists insisted that this might bring about 450,000 British immigrants to Australia over the next decade, but for the most part the legislation
brought only further confusion. The failure of sponsored schemes in Western Australia, Victoria, and New South Wales became obvious before the end of the 1920s. Worse, most of the state legislatures had engaged in an imprudent rush for the “cheap money,” and a hard-won conservatism in rural settlement policy and practice was crushed by a nationalist-imperialist enthusiasm that justified the opening up of virgin land on the drier margins and the subdivision of hundreds of big properties used for livestock and wheat production. This initiative brought a number of people, as yet uncounted, to areas of proven hardship. Many were new to farming, and most were unaccustomed to semiarid conditions; some were certainly new to both and to Australia. The wider Australian community’s expectations of more productivity from marginal areas placed a special burden on the settlers, since the pioneers’ reliance on the governments’ provision of a generous array of credit facilities made it easy for others to stereotype them as quasi-mendicants.

Scientism and the Welfare State

During the interwar years, planners around the globe invested high hopes in science and particularly in the “new” science of ecology. New Deal scientists in the United States seemed to have a chance to produce a coordinated program of conservation drawing on expertise from many disciplines, but instead they drew up a number of discrete sets of recommendations. “Perhaps,” Donald Worster writes, “that is where reliance on scientific experts inevitably must lead” (Worster 1979, 198). Of the American scientists who promoted the role of ecology in public planning, possibly the best known internationally were Frederic Clements and Paul Sears. They combined to make an urgent case for scientific leadership on the plains of the United States, with Sears explaining that scientists were already deeply involved in developing the British Empire’s resources. The irascible Kansas historian James Malin correctly divined that such scientific managers were threats to the myths of “statism” and scientism erected by the prevailing economic culture to limit American freedom, but few ecologists had the time or the inclination to follow their creed to a full critique of American ways of life and remained firmly planted in the universities and colleges. They offered their expert advice to the planners, “then backed off from the job” (Worster 1979, 209)—avoiding the martyrdom suffered by Griffith Taylor.

The U.S.S.R. and China

A harder rationalism introduced agrarian communism in the U.S.S.R. and in China. By 1928 about 25 million peasant holdings, averaging 37 acres each, existed in the Soviet Union. Cossacks, wealthier peasants, seminomadic Kazahks, and others bitterly opposed their collectivization, destroying their own crops and livestock. Some peasants did approve of the movement; and by 1940, after a great deal of suffering, about 97 percent (75 million) were based on 235,000 collectives, with the remainder scattered over remote districts. During the early phases of collectivization, planners claimed that communization approached a return to traditional village life. Such rationalizations disguised the single-mindedness of the mission but were congruent with what was probably an equivalent understatement of the productivity of the original peasant system. Economics of scale permitted greater mechanization on the collectives, together with a more efficient deployment of technical and scientific expertise. The state farm, in which the workers were government employees, became a favored alternative after World War II and was significant in the pioneering of new methods and new regions. A rapid amalgamation of the old collectives and the transformation of some of them into state farms roughly equalized the numbers of both types by the early 1980s (Shaffer 1977; Stuart 1983).

One implication of the state farms is that man can overcome nature and imprint the
directives of a central authority on the landscape. In the late 1950s, state farms spearheaded a massive entry into Kazakhstan, western Siberia, and other previously intractable semi-arid plains, inspiring the Chinese to begin agricultural expansion into their own dry north (Pannell and Ma 1983; Yao 1968). Westerners have had difficulty in assessing these activities because the outlines are obscured by a context of stubborn regional preferences and the planners' expectations of agricultural support for favored industrial programs. Although the Soviet and Chinese expansions fall outside the period between the world wars, the similarities to what was happening elsewhere in those years, particularly in terms of regional preference, scientific imperative, and centralized planning, are instructive. China's expeditions into "virgin land" between 1958 and 1965 called upon the earth sciences to counteract the water imbalance between north and south China (Chung 1968). But in the United States—the very country that had fostered advanced soil science between the wars—economic ambition and difficult seasons won out over science and planning, combining to aggravate six years of wind erosion that severely damaged over twelve million acres of sown land, leading to the abandonment of most of it for farming.

CONTRIBUTIONS OF SCIENCE: AUSTRALIA

If science failed to restrain ambition in the United States, it did prove "subversive" to non-British cultures in the British Empire, especially when mixed with ignorance of other cultures. In order to understand this phenomenon, let us begin by returning to Australia. Australia used science in the public service during the twentieth-century expansion of the grazing and wheat frontiers, but science did not always give reliable answers. While a holistic view appealed for a time to Australia's botanists, it did not produce successful range management strategies, particularly because there was no unequivocal evidence that the range vegetation had markedly deteriorated everywhere, despite generations of opportunistic grazing. By the later 1930s, some scientists were apparently converted to the folk wisdom that described vastly more dynamic vegetation communities—there was at best a "fluctuating climax," which therefore offered successions of good and bad seasons. The enthusiastic application of dry farming principles in Australia's wheat belts also produced sporadic results. Twenty years or more before the development of sophisticated dry farming in the United States, wheat farmers in southeastern Australia had established varying degrees of reliance on fallowing techniques, but in the early years of this century a veritable dry farming cult mushroomed after leading politicians and bureaucrats returned from a study tour in North America (Williams 1974; Powell 1976). The subsequent unreserved application of American practices to much drier regions in Australia was an unusual example of official and popular accord—but one that led directly to catastrophic soil erosion, with related bankruptcies and abandonments. A similar example is provided in the half-century lag between British scientists' proof of the value of superphosphate as a fertilizer and its adoption in Australia. Despite the efforts of agricultural research stations and the evangelistic efforts of J. D. Custance of South Australia's Roseworthy College, public opinion remained hostile to such "book learning" until two ordinary farmers made independent experiments using small amounts of the fertilizer in conjunction with American seed-drilling equipment. That was the spur and, at last, official disseminating agencies successfully marketed the idea—so began Australia's dependence on superphosphate.

In her study of the northern Great Plains, Mary Hargreaves (1957) explained that conservatism among agricultural scientists may have limited the impact of their work. In Australia the comparative dearth of the educational and research institutions where such scientists worked has a positive as well as a negative side. Homegrown practical solutions—or ideas that appeared to be homegrown—frequently had
maximum effect. Pioneers used their own enterprising clearing and plowing devices across Australia’s southeastern states. Long before the discovery of Mendelian principles of genetics, a Cambridge-educated immigrant, the former surveyor William James Farrer, toiled alone in the backcountry of New South Wales to breed varieties of wheat. Farrer later worked with Department of Agriculture chemist F. B. Guthrie and before World War II dozens of their new strains—commercially viable, early maturing and therefore both drought-tolerant and rust-escaping—dominated the Australian wheat industry and were used by international correspondents. In its immediate utilitarian relevance this cooperation was one of the best kinds of adaptation. Government departments of agriculture had sponsored similarly novel programs over the years, and accommodated a few highly gifted individuals, but they remained essentially administrative agencies charged with the diffusion of existing knowledge rather than original research.

The Australian scientific community operated with a number of handicaps during the interwar years. Funds were meager. Distances prevented specialists in the same field from conferring regularly with each other. Universities were small and few, and most academics who were not swamped with teaching were preoccupied with achieving “international” (i.e., non-Australian) recognition in their field. Even when the Australian government established the Council for Scientific and Industrial Research (CSIR) in 1926, Prime Minister Stanley Melbourne Bruce and other leaders expected it to serve as a kind of conduit for the transfer of British science to Australia. Although the politicians and bureaucrats, accepting client status within the empire, brought British experts on visits to set down research guidelines, this flurry of activity failed to consolidate the old traditions of dependency.

This deliberately overstates the case for the development of scientific nationalism in Australia, but an explanation of these underlying tensions is necessary for understanding the role of science in helping Australians adapt to semiarid grasslands and savannas. In the early years of the CSIR, T. B. Robertson, a graduate of Adelaide University with long postgraduate and professional experience in physiology and biochemistry in the United States, proposed a program of fundamental research on the connections between animal nutrition and wool and meat production. David Rivett, chief executive of CSIR, probably gave the nod to this attractive lead program because it promised exciting research exemplars. In Britain, however, Robertson’s experiments were heavily criticized—not only on pure scientific grounds but also by those who sought or claimed an imperial monopoly and thought the Australian should concentrate on the adaptation of existing knowledge to local conditions. He steadfastly declined to act as a mere laboratory assistant.

Grossly overworked, Robertson died at forty-five, but his successors were inspired by his stand and soon moved on to clarify important interdependencies between agrostology (botany of grasses), soil chemistry, biochemistry, and physiology. Their research demonstrated the significance of trace element deficiencies in regional soils, first with the dramatic discovery of cobalt deficiency in calcareous coastal districts and later with the discovery of copper, zinc, molybdenum, and selenium deficiencies, the correction of which augmented the grazing potential of every state. The development of vaccines for black sheep disease in sheep and pleuropneumonia in cattle also exemplified a distinctively utilitarian Australian science, though the Empire Marketing Board and the Pasteur Institute in Paris contributed to this effort. Economic entomology, a new field in the 1920s, proved to be a particularly good area for demonstrating Australia’s independent national effort in applied science. Scientists achieved spectacular results in biologically controlling the prickly pear, an introduced plant pest that was invading thousands of square miles of pastureland in Queensland and New South Wales, by introducing Cactoblastis cactorum, a natural
predator. This triumph won the scientists further security within Australia and encouraged the pursuit of additional fundamental research without resort to any cap-in-hand apologia.

The launching of the CSIR’s division of economic entomology in 1928 resulted in the design of ambitious programs to counter rabbit and locust plagues and to control major pasture weeds and the sheep blowfly. The 1930s depression brought a fresh influx of funds to the CSIR’s applied research teams: a prominent example was the decision of the Australian Wool Board, created in 1936, to support the CSIR and not the university departments. Unfortunately, after 1945 political pressures as well as the lure of private industry and “big science” enticed gifted individuals away from public service and hampered CSIR research. We know too little about the role of science in the Australian polity to do more than begin a comparison of Australian and American experiences in agricultural research. Possibly, more of Australia’s applied scientists became lost in their own version of the bureaucratic machine, or there may have been smaller representations of highly competent scientists and technologists in senior positions in our service agencies. Certainly absent were individuals like Hugh Hammond Bennett, an excellent publicist and political tactician who guided America’s Soil Conservation Service through the thirties and forties. A detailed history of the CSIR (CSIRO) will soon be published, and it may disclose the extent to which its leaders were drawn to opposing models in the foundation years of boom and depression—to academia’s staid departmental structures or to more flexible, mission-oriented frame works. (But that history may in itself show the influence of American commentaries on Australian historical researchers—cf. McDean 1983; Hall 1983; Peterson 1980).

SETTLEMENT AND THE SOCIAL SCIENCES

In comparison with the situation in other parts of the New World, the social sciences in Australia remained underdeveloped and underconsulted. Yet the payment of society’s “debt of honor” to returning war veterans by land settlement seemed to be obvious and natural to both Australians and Canadians, and offered a role for social sciences. About seventy thousand veterans and their families were involved in settlement schemes in the plains of both countries. In Canada federal government controls and the application of rural sociology models were stronger. In Australia nationalistic and imperialistic sentiments permeated most of the schemes, and high levels of emotionalism, along with the well-meaning but frequently muddled activities of local patriotic associations, did little to promote rational planning measures. A shaky partnership between Australia’s federal and state authorities led to a diffusion of settlement over dry and irrigated estates and individual small farms and to unfortunate divisions of responsibility among local, state, and federal authorities and a host of voluntary agencies.

The Australian confusion was understandable. A very young nation of about five million souls suffered 60,000 dead and more than 100,000 other casualties, proportionally more than any other empire country. Approximately 250,000 discharged soldiers had to be reinstated in civilian life. In the rush to find a solution, elementary economic and environmental appraisals were forgotten and agricultural research, marketing strategies, and farm training programs received little consideration. Settled on high-cost lands in confident times, within less than a decade the veterans were struggling with prohibitively high mortgages and production costs as world commodity prices were falling. By the late 1920s, thousands were declared “failed.” Yesterday’s heroes, they were mown down at last by mismanagement, relentless economic pressures, droughts, and floods—and by a marked reversal of the previous goodwill shown alike by lands administrators and the wider community. The gap between yeomen and bureaucrats—that vital barrier to the dialogue required for secure adaptation—widened
again. The federal government was obliged to intervene to adjust loans and farm sizes around the country, another small step toward centralization in Australian affairs. Even so, there was remarkably little empathy with those veterans who obviously found it agonizingly difficult to complete their rehabilitation on Australia’s lonely backblocks. The psychological dimension was not deeply investigated and sometimes individuals were ruthlessly discarded in arrogant bureaucratic memoranda: “Not a trier”; “Weed, mentally and physically”; “Very bad type. Wilfully neglected stock and plant”; “Lazy and a drunkard.” Yet the combat experience of the “failed” settlers as a group was probably fully representative of the Australian contribution to the cruel stupidities of Europe’s war (Powell 1985). Additional local investigations may show that new social divisions were created in this period in many small rural communities. Although that remains yet another unwritten chapter in the interpretation of settlers’ adaptation on the plains, the lessons of the debacle did contribute to the success of similar schemes after 1945.

Canada’s federal program was markedly paternalistic, at least in the beginning, and showed some of the influence of U.S. progressive rural sociology. Town-planning adviser Thomas Adams, who represented the British school of community planning, called unsuccessfully for a “scientific organization” of the soldier settlement project to intensify existing settlement in established regions by means of compact, cooperative colonies and mixed Garden City-style estates. The Soldier Settlement Board had different but ambitious aims, supervising the settlement process on about five million acres of the prairies. The hesitantly expanding work of the Home Branch provided a vital complement to the Board’s hard-won expertise in financial administration and technical supervision, if only in its efforts to provide home management courses and the like to rescue the pioneer’s wife from “a mental oasis on a prairie farm” (Powell 1979, 1982a). The Adams-style community system was rejected in favor of old-style individualistic endeavors, yet by the end of the depression a 75 to 80 percent retention rate of soldier settlers was claimed for the prairie provinces. In fact, the Settlement Board was judged one of the more valuable institutional adaptations, and its responsibilities were subsequently extended. Not everyone was pleased, however. As in Australia, some observers feared that the settlement schemes were dangerous departures from traditional capitalism, with the effect of shedding the healthy self-reliance of the pioneers for a weak-willed dependence on the state. Like Australians, Canadians were unsure of their national ambitions; also like the Australians, many Canadians interpreted experience in terms of the lessons of pioneer settlement. The settlers did not want to be treated as guinea pigs or as chips in a game of chance. And, at least in some cases, the most abject “failures” by official description may have succeeded very well indeed by their own reckoning—they moved on, profiting financially and in farming experience.

Water and Economy: The Sudan

In both Australia and Canada, the agricultural settlement of semiarid lands was carried out by European-descended peoples who easily accommodated to British forms of government. When settlement schemes were imposed by imperial policymakers on peoples with totally different cultural backgrounds, the problems involved in the projects were quite different, as we can see by turning to an African example. After the battle of Omdurman in 1898, the Sudan was made a condominium under Anglo-Egyptian control. The Sudan was the ward and Egypt very much the junior partner; it was therefore left to the British, as they saw it, to bring “civilization” to the Sudanese people (Gaitskell 1959). Sudan’s traditional semisubsistence economy was based on peasant farming and nomadic pastoralism, offering only gum, hides and skins, ivory, and ostrich feathers for world markets. The British confidently declared that the Sudan’s most pressing need was more British
officials and rapid capital investment in railways and irrigation. The Gezira project, south of Khartoum between the Blue and White Niles, became the cornerstone of this great imperial adventure in an increasingly bureaucratic and technocratic age, an age far more like our own than the popular images of governors’ levees and tiger hunts suggest.

The mysterious sources of the Nile were unknown to the Western world until the expeditions of Speke, Burton, Baker, and Stanley in the late nineteenth century. Less spectacular expeditions made by senior engineers in the early twentieth century also frequently yielded valuable accounts of natural and social environments. Although these engineers failed to decipher the fascinating geohydrological history of the region, which is highly complex and crucial to an understanding of intransigent management problems, including salting (cf. Williams and Adamson 1982), the early engineering expeditions not only resulted in a gigantic project but also served as a remarkable training ground for imperial technocrats. With Indian, American, and Australian experience to draw upon, the Gezira scheme was multipurpose from its inception in 1904. Long staple cotton was to provide the economic base, but its cultivation entailed a complex conversion of the peasant farming communities and newly devised crop rotations to maximize productivity and minimize soil losses and reductions in the quality and volume of water. Meanwhile, Egypt’s ancient rights to the downstream flow had to be safeguarded. A novel partnership agreement was drawn up among the condominium government, a private management syndicate with guaranteed connections in the Lancashire textile industry, and the tenant cultivators. Tenants held their land from the government, which in turn rented it from the original owners; food and fodder crops were retained by the tenants; the cotton crop was handed over to the management for marketing, the tenants retaining a share of the proceeds proportional to the amount of cotton they delivered. Paternalism did not extend to land nationalization, yet control was quite effectively ensured by restricting, not removing, traditional proprietorial rights. Similarly, since the government took on the rental for forty years there could be no immediate problem with incremental values; and finally, neither land nor crops could normally be used to secure mortgages or debts of any description.

The Sennar dam supplied over 300,000 acres of the Gezira. A regional research farm maintained a close liaison with the Empire Cotton Growing Association and Britain’s Rothamsted Experimental Station; visiting consultants of the highest repute were brought to the Sudan, and a London Advisory Committee proffered regular critiques. The Gezira project represented the “trusteeship” strain of empire which aimed to build up the dynamic indigenous economy while ensuring that the new wealth was not concentrated into the hands of a favored few. The outstanding early technical successes of the project encouraged further expansions that were accelerated in the 1950s, when the irrigated area grew to about two million acres. Income returned to the Gezira has indeed been widely distributed among a tenant population numbering more than 300,000 families, plus some 500,000 seasonal laborers from West Africa and Western Sudan. The tenants generally resisted the managers’ efforts to place them on easily monitored individual blocks; the compromise was a fairly regular dispersal of villages, the peasants’ preferred settlement form, at intervals of two or three kilometers along the distributary canals. Schistosomiasis, already endemic in the Sudan, increased on the Gezira and remained a problem despite the treatment of infected canals with copper sulphate. Egypt’s claims on the Nile were strengthened by an engineering-dominated agreement in 1929, but the remaining uncertainties made diplomacy an additional water management skill.

The trusteeship claim began to ring hollow in the interwar period and the unfinished history of the Gezira project still carries a
warning. The Gezira might have launched a “Sudanization” process, but transfer of power did not occur until after World War II, precipitated by urgent local demands, international affairs, and the revolution in Egypt in 1952. The Gezira was also an early example of the kind of “growth pole” tactic favored by Western and communist planners alike, but its attraction for successive Sudanese governments exposed the one-eyed inefficiencies of the approach. The inheritance of regional inequality became oppressive in the postwar world, and was an immediate cause of rebellions in the 1960s and 1970s when over one million people perished through famine, disease, and widespread violence (Roden 1974). In the wider context, the source-to-sea division of a single hydrological system between several independent nations was another unfortunate legacy of European imperialism.

**African Development**

Variety was the keynote of development in Africa’s semiarid territories during the period between the world wars, and the Gezira is more unique than representative; in fact it may be more realistic to evaluate it internationally, against other contemporary irrigation enterprises. Yet it contains important commonalities central to much of the African experience in the nineteenth and twentieth centuries. Throughout Africa a deliberately increased emphasis on export crops accompanied the emergence of a highly dualistic agrarian economy, peasant and plantation, or quasiplantation, side by side. The export-oriented enterprises benefited from the selection of soils and other natural conditions, sophisticated administrative and credit facilities, agro-scientific expertise, and a highly capitalized infrastructure for storage, transportation, and marketing, while the peasant sector was often denied these advantages. The Gezira only partially escapes this censure because of the planned rotation of peasant-plantation crops in a sequence designed essentially to improve the commercial enterprise.

The autonomous but unstable govern-
by the threatened emergence of communism in the less developed world. Such concerns were voiced less often during the contemporaneous consolidation of similarly large government-controlled schemes in Australia, where since the 1880s irrigation had been accepted as a small but integral part of a much vaunted "State Socialism." Modern Western observers accept irrigation as resource development investment—making deserts bloom in relatively restricted but well selected localities—or as stabilizing rural production over much wider areas. For most New World countries the overriding appeal of the first of these alternatives is undeniable. Public enthusiasm for irrigation in Australia soared after major droughts in the 1870s, 1890s, the early years of this century, 1911, and during World War II, but until recent decades the projects seldom focused on the second alternative. Australia's socialistic adaptations partly reflected the environmental naivete' and political strength of the nation's overwhelmingly urban communities, but were also dictated by the realization that enormous investments would be required to combat a demanding physical environment. Political theorists and progressives of various persuasions could choose to see government intervention as appropriate to the times, and promising a more equitable distribution and effective use of scarce supplies. Thus a simple nationalism was woven through all the schemes for using Australia's land and water.

Australian governments favored "intensive" schemes of group settlement to benefit as many families as possible. New irrigation projects, frequently associated with closer settlement schemes in each state, were justified as maximizing opportunities for pioneer farmers and providing increased security for the family farm. The imperial pattern is evident in both the preliminary design and in subsequent routine management, where it penetrated most areas of administrative, legislative, and technical practice. Western American experience was also highly influential. From the 1880s, water management in Australia had its share of visiting experts, but this was more than balanced by local knowledge and by the early employment of an uncommonly productive variant of the overseas study tour. Lessons from Egypt, India, Italy, and the United States were carefully sifted and widely circulated. John Wesley Powell offered his views, and there was considerable interest in the advice received from the state engineers of California and Colorado. In the colony of Victoria the innovative riparian legislation that effectively nationalized all surface waters built on outside advice as well as upon tortuous mining litigation of immigrant Californians in the 1850s and 1860s; it borrowed from administrative and legal initiatives in British India and from contemporary local enactments.

Unfortunately, the Australians elected to rely solely upon superficial engineering perspectives in the construction of the irrigation works, instead of using their talented geologists to research the ancient geomorphological history of the riverine plains. This contemporary preference for undisciplinary approaches missed the practical significance of the geomorphological record to irrigators. The Murrumbidgee riverine district, for instance, has been shown to be a Pleistocene alluvial plain resembling the current plains of the Nile and bearing little relationship to today's rivers. The higher discharges and steeper gradients of its ancient streams enabled them to carry more sand and gravel than today's highly sinuous Murrumbidgee, in which silt and clay are predominant. Such detailed features profoundly affect drainage, irrigation, and crop yield, but were not well understood until the postwar diffusion of synthesizing land-type analyses developed in the United States at the end of the 1930s (Langford-Smith and Rutherford 1966; Hudson 1936).

The American connection was important, but movements were two-way. In 1907 the nomadic Elwood Mead left his position in the U.S. Office of Irrigation Investigations to take up his appointment as chairman of Victoria's State Rivers and Water Supply Commission. Still inspired by the dream of using irrigation as a lever for social reform (Pisani 1983; Powell...
1976), Mead, over the next eight years, supported both “extensive” or partial irrigation to stabilize dry farming enterprises and intensive schemes of the closer settlement variety. Clearly he then favored the latter, and this preference led to an imbalance that strengthened after his departure from Victoria. Back in the U.S., Mead maintained his Australian interests (Powell 1982b) and acted in a lucrative consultancy capacity from time to time. In 1923 he investigated progress on the Murrumbidgee Irrigation Area (MIA) for the New South Wales government, emphasizing the need to integrate irrigated and nonirrigated areas by fattening sheep and other dryland stock on fodder crops, and particularly on specialized lucerne (alfalfa) farms, in the irrigated districts. At the time, Mead’s advice fell on deaf ears. Rank and file settlers, historically as relevant in that region as the transplanted experts, were joined by broken miners from Broken Hill and by the equally troubled returned soldiers, and they eventually combined to win concessions from the state government.

IRRIGATORS AND POLITICS: AUSTRALIA

By the late 1920s the several specialized experimental research stations in the MIA maintained close liaison with government scientists, but the absence of effective extension services handicapped the diffusion of findings on soils, salinization, and rotation systems. The continuing cooperative spirit among the settlers filled the gap. Four farmers joined the scientific advisory committee for the region in 1927; more farmers were appointed in 1938 and in the war years additional representatives were appointed from the Rural Bank, the Department of Agriculture, and the farmers’ cooperative organizations. Another broad-based body, the Irrigation Research Extension Committee, included representatives from the farmers’ cooperatives after 1941 and was further augmented from the Universi-

FIG. 2. Major irrigation regions of southeastern Australia, showing principal rivers and average annual rainfall (in inches). The Murrumbidgee Irrigation Area, discussed in the text, is identified (MIA).
ty of Sydney, the Soil Conservation Service, and elsewhere. The result was not only a well-staffed headquarters circulating large quantities of information, supervising field days and group meetings, and coordinating hundreds of volunteers, but also an influential forum for the airing of farmers’ grievances—the MIA’s own “agricultural parliament.” This example of regional enterprise lost its effectiveness during the 1950s, when it was swallowed up in the labyrinths of the New South Wales bureaucracy.

But flexibility is necessary for survival in an erratic climate and these novel adaptations in the MIA did not mitigate the rigidities common to closer settlement schemes dependent on irrigation. In Australia the engineer’s passionate concern that all water be applied to maximum effect by every user normally led to the agencies’ zealous insistence on intensive cultivation and an ostentatiously paternalistic control over the physical planning of the irrigation settlements. To some extent the emulation of MIA-style cooperation tempered this single-mindedness, but in general all parties were agreed that the intensive system was to be preferred. In Australia a way-of-life option was preferred to cool efficiency—a theme that many commentators continue to find exasperating and enviable. The main concessions won by the settlers involved protecting their individual stakes in the scheme, not challenging its fundamental assumptions. Settlers were inclined to agree with a distinguished official arbitrator that it would be unreasonable to ask a pioneer farmer to accept an average income below that of a mere water bailiff. Contemporaries believed that the local communities had forced adaptations in the system: in review, the opposite effect could have been claimed with equal validity. Irrigation is now regularly rejected by Australia’s economists (e.g., Davidson 1969).

The emergence of sectional tensions and the development of new farming frontiers remote from the settled fringes led to regionalist political movements. Irrigators, small wheat farmers, and wheat-and-sheep farmers alike supported a fledgling anticentralist Country party that adroitly held the balance of power at federal and state levels for long periods during the interwar years. It was intimately associated with several very popular “new states” movements, and with secessionist interests in Western Australia and in the Riverina of New South Wales, where the MIA provided a strong nucleus. Much of the agitation was antiurban, demanding better rewards for those who claimed to be the real pioneers of Australia. The uncertainties incident to life in the semiarid plains, together with the wider center-periphery tensions in the young nation, involved pioneer farmers in continuing political and economic agitation.

**Families and Other Institutions**

The settlement margins of Argentina and Canada offer provocative contrasts to those of Australia. Wheat farming prospered on the large estates of the pampas, supported by phenomenal waves of immigration. Argentina was part of Britain’s informal empire, but its immigration program was dominated by southern Europeans—most of all by millions of Italians, who were generally content to become laborers or tenant farmers and took little part in Argentinian politics (Solberg 1982). In contrast, except for Clifford Sifton’s attempts to attract colonists from eastern Europe, Canada’s restrictive immigration policies brought prairie settlers mainly from Britain, northern and western Europe, the United States, and the older provinces of Ontario, Quebec, and the Maritimes. Homesteading was the rule and popular participation in Canada’s democratic politics an established tradition. Accordingly, strong agrarian movements developed to safeguard the interests of the peripheral region (Mackintosh 1924; Wood 1924; Morton 1934). The pampas was comparatively densely populated and this, together with its entrenched connections with the capital, guaranteed that there were few of the problems with industrial tariff protection that plagued wheat farmers on the plains of
North America and Australia. Argentine agriculture was therefore given a competitive edge by the lower costs of labor and imports, including farm machinery; in addition the tenant farmers, however poor their condition otherwise, were not burdened with heavy mortgages, and rentals were often reduced when agricultural prices followed a sustained decline (Solberg 1971). Climatic restrictions in the prairie provinces reduced opportunities for diversification from wheat, a favored strategy in Australia. In the 1930s the collapse of world prices and a succession of droughts bankrupted many prairie communities and, as in Australia, farmers sought government assistance in the form of soil conservation programs, various types of loans and debt adjustments, wheat stabilization schemes, and the like. In Canada the old option was still being exercised to some extent—moving on to virgin country—but that had become less common in Australia’s wheatlands.

None of this says enough about the most valuable institution in any rural region, the family. Whether nuclear or extended, the family offered farmers all their props and most of their motivation, yet it is today often ignored or sentimentalized. Families allowed the pooling of labor, finances, knowledge, and emotional investment, so families often settled in earlier and survived when individual homesteaders went to the wall. When they had to leave in mass regional emigrations, their plight was sung in literary classics of the 1930s. Building on more ancient traditions, Mikhail Sholokhov’s *Quiet Flows the Don* and John Steinbeck’s *Grapes of Wrath* captured some of the essence of land-rootedness that Wordsworth had explained over a century earlier—the land was “a fountain fitted to the nature of social man from which supplies of affection . . . are daily drawn” (see Craig 1974; Jensen and Miller 1980). Many of the farmers of the Russian steppes and North China Plain were new to those regions, new to farming, and so the land did not symbolize the way of life of their ancestors. Families in the semiarid regions of the New World were scarcely peasants in any Old World sense; even so, the territorial bond was obviously threatened, and it remains difficult for Australian and Canadian readers to understand why Steinbeck’s migrants never organized. Is it true that American rural society remained stratified, that aid to the rural poor was less generous during the New Deal than it might have been? If so, are we merely dealing with a continuum, capitalist-socialist, with the two British Dominions occupying central positions? It can’t be that simple.

Although there were collective adaptations on the Australian and Canadian plains that took the form of bold and durable expressions of regional identity, in order to understand them we need more methodical local analyses of the changes in family farm structures—in good oral history, in empathetic fiction like *Grapes of Wrath*, and in the kind of work in social anthropology that John Bennett and his associates have produced for Saskatchewan (Bennett 1982). As for the differences between the forms of rural protest in Australia and Canada, my tentative view is that the three adjacent prairie provinces offered an unusually extensive and homogenous base that was not matched in Australia, where similarly disaffected communities were scattered around the desert heart, obliged to direct their venom at individual state authorities as well as the Commonwealth government. Agricultural adjustment and other government interventions in Australia and Canada are now long-established elements of rural living. For the United States, Worster and others claim that the opportunities for fundamental social reform were not realized—neither in the administration of various relief measures nor in rural planning. The New Deal brought no new deal for the rural poor; rather it conserved and protected corporate capitalism by assisting those with greater political and economic muscle. In Australia and Canada some of the louder calls for reform came from organized rural groups. Admittedly, neither country boasts the volume of interdisciplinary research which has illuminated this period for the
United States, yet there is enough to suggest that extremes of wealth and poverty were rather less apparent and that plains people had found ways of using their governments. The exceptions are Indians and aboriginals, the dispossessed, for most of whom Depression was the normal condition, environmental destruction a continuing tragedy. Forty years later, when these indigenous peoples at last developed their own protest movements, rural communities that had often displayed their own best skills in similar campaigns bitterly attacked native claims to unique land rights.

CONCLUSION

In all our examples, despite regional protests, control over agrarian economic policy remained outside the producing regions: whether wheat farmers, graziers, or irrigators, the peoples of the semiarid lands were dependent upon decisions made in humid, industrializing fringes—which were in turn still peripheral to the metropolitan hearths. Donald Worster identified with the last generation to find their dreams in American land, and described how an economic and ecological crisis left only “a cultural boneyard, where the evidence of bad judgment and misplaced schemes lie strewn about like bleached skulls” (Worster 1979, 3). As a paradigm for environmental history Worster’s interpretation extends beyond his original specification of time and place, and the complex varieties of adaptation on the world’s semiarid plains reveal an interweaving of modern, traditional, socialist, and capitalist modes that the casual vocabulary of “success” and “failure” obfuscates. The international perspective also discloses that any tight focus on plains areas alone—however convenient or dramatic that appears to be for committed ecological and literary scholarship—may prove fragile or even self-defeating.

The mission of our teaching and research in the modern history of the world’s semiarid lands requires us to communicate the sense of a profoundly significant community of interest and a proper grasp of continuity. The resonances of the interwar crises remain pervasive and beckoning. Those crises were at once environmental and social, political and administrative; parsimoniously set in any single national context they are oversimplified and even incomprehensible. It must be made clear that neither capitalism nor socialism nor any admixture of the two has provided a satisfying, ecologically adaptive culture. Over the past fifty years, reformers have tried to put their various houses in order (Sears 1937) with only limited success. Perhaps the indulgent fragmentations of academic discourse distort our perceptions, thereby compounding the very problems we address and reducing the utility of our approaches for the wider community. We might do more to close the gap between our formal programs of teaching and research and the rich heritage of vernacular modes of inquiry. And our interpretations need not commence with economic ideologies in every case but with the experiences of actual settlers and with interdisciplinary sorties of pure and applied science: so we may have a science for citizenship, not for the scientist or for the sake of science itself; and today, more than ever before, it must not be designed solely for the kind of “nation planning” so dear to Griffith Taylor but rather for world citizenship. Only then, as Earth and Mankind intertwine in stressful coauthorship, can they produce a legible document for a sustainable future.

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