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SOMALIA SOIL AND WATER CONSERVATION

CEEL BARDAALE AND ARABSIYO

PROJECT IMPACT EVALUATION

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PART I

INTRODUCTION

The first agreement for AID's Soil and Water Conservation project (649-11-120-019) was signed in May 1961. It consisted of five sub-projects, each of which addressed soil and water conservation problems in five different areas of Somalia. One of the five designated areas was in the then Northern Region. The purpose in every case was to "...counteract economic losses to Somalia resulting from uncontrolled runoff of water causing severe damage to land and agriculture, and causing severe shortages of water for domestic and farming use..."

A work plan was prepared for the Northern Territory sub-project in early 1962 that centered on the Arabsiyo Valley. This project actually began in January 1963, four months after the arrival of Calvin Wixom, who became the only U.S. project manager for the sub-project until its termination in January 1967. A June 30, 1966 amendment to the Project Agreement added the Ceel Bardaale community to the project scope and work plan.

This impact evaluation, some twenty years after the beginning of the project, was done as one of many impact evaluations of AID irrigation projects worldwide to determine findings and lessons learned that would improve the design, and, therefore, the productivity and income results of AID irrigation projects for the primary intended beneficiaries, i.e., the small farmer.

The team's month long visit to Somalia coincided with the end of the dry season which did not afford any opportunity to view the bunds and floodwater irrigation structures under water flow conditions. The entire field time (three weeks) was spent in the North West Region at the Ceel Bardaale community and in the Arabsiyo Valley.

PART II

PROJECT SETTING AND DESCRIPTION

The Northern Territory sub-project of the Soil and Water Conservation project had the following design features:

Goal: To promote social progress and better standards of life, and advance the economic, social and technical development of the Somali Republic through Agricultural Development.

Purpose: To advise and assist the Government of the Somali Republic and the people of the Northern Region to establish soil and surface water conservation structures in an effort to conserve rain water run-off for crop production.

Regarding outputs, those for Arabsiyo specified a 100% increase in crop yields on the 1300 hectares to be bunded in the project area. For Ceel Bardaale, the outputs were an unspecified number of structures, e.g., canals, gates and turnouts which would intercept floodwaters and channel them to the fields. Bunding would also be done as appropriate. Demonstration and self-help were planned as major parts of the Ceel Bardaale plan of action.

The Arabsiyo valley and the Ceel Bardaale community are located north and west of Hargeysa, the principal market center for the North West Region and Somalia's second largest city with an estimated population of 300,000 swollen, in part, by Somali refugees from Ethiopia. Both sites are located in the potentially most agriculturally productive area in the northwest. Like the rest of Somalia, the region is subject to long rainless periods, possesses no year-round surface water flows and experiences

periodic extended droughts which wreak havoc on human and animal life alike. The toll in livestock is economically the most disastrous since about 85% of the country's foreign exchange earnings are derived from livestock and animal product sales to the Gulf states and elsewhere; the North West Region is the principal producing area for livestock in Somalia. Livestock production is the income basis of the nomadic peoples who are a major element of the northwest population. In addition, however, there are semi-nomads who turn to agriculture when climatic and economic conditions are rewarding but who keep their herds for fall-back income insurance when the rewards are not present. Permanent farmers comprise less of the rural population.

The Arabsiyo watershed, the focus of AID activity at the outset of the project, was a small catchment which was not as badly eroded as others in the area and had the additional advantage of proximity to an all-weather road for access. Under the supervision of Calvin Wixom, the USAID soils conservation advisor, preparatory survey work was done by the Ministry of Agriculture staff leading to a decision to begin bunding at the southern end of the watershed near the towns of Teysa and Xidhintu. Wixom planned to build three bunds for every one built by the farmers using oxen using bulldozers driven by the Ministry of Agriculture staff. The bulldozers were so much more efficient at building the bunds that this farmer self-help aspect of the project was dropped. The placement of the bunds was determined by survey and locations were originally selected irrespective of farm boundaries.

In 1966, Wixom began work at a second site located some 70 Kilometers northwest of Arabsiyo at the Ceel Bardaale community. The community, a religious cooperative formed in 1960 by Shiikh Maxammad Raage, had been instrumental in getting AID's second project site located at the community's newest settlement. In contrast to Arabsiyo, the community's efforts were clearly directed towards increasing water distribution from the togs to newly cultivated citrus areas. Very little attention was given to soil conservation. One of the major objectives sought by the community was to demonstrate the feasibility of farming in the northwest.

PART III

A. AGRO-ECONOMIC ANALYSIS

Of the total surface area of the North West Region less than 5% is considered arable, some 200,000 hectares. Within this area, as within all Somalia, the primary limiting factor to agricultural production is water. The two sub-projects evaluated were two quite different and yet appropriate attempts to cope with the problem of increasing and sustaining agricultural production in a semi-arid environment using simple irrigation methods. They are in a sense opposite sides of the same coin: one making use of the limited rainfall in the upland areas and the other utilizing the run-off from rainfall in similar areas which collects in the intermittently flowing lowland streambeds, togs. It is reasonable that they should be evaluated with regard to their individual internal characteristics so long as one does not lose sight of their pilot demonstration status and goals.

The bunding sub-project in Arabsiyo Valley was funded as a soil and water conservation project; though laudable for its conservation efforts it has been viewed locally and indeed was conceptualized originally as primarily a crop production scheme. The spacing of bunds and their placement on the hillsides was clearly intended to gather rain water run-off from the immediate surrounding area and channel it to impoundments behind earthen dikes, or bunds, for crop use. Given locally available rainfall data it was calculated that maximum crop production could be realized from three times the average annual rainfall; the bunds therefore were to be placed in such a manner as to capture the

run-off from twice the actually cultivated area^{1/} It is a primitive type of irrigation, water gathering, which has seen widespread application in a variety of forms for thousands of years.

The actual genesis of Ceel Bardaale as the second sub-project is unclear, but it is not unreasonable to suppose that the specific idea to undertake diversion irrigation on that particular site originated within the community itself which then actively sought the resources to carry that idea to fruition. One of the leaders of the community had had extensive experience in bunding having worked with the British bunding project in the 1950s, and though he had great imaginative powers he likely lacked the necessary skills to design and construct works adequate to exploit the occasional torrents of water which flowed down the togs towards the sea. Early examples of diversion irrigation schemes, some quite sophisticated, are known from antiquity, but the team saw no indications that modern efforts using adjustable control structures were known in northwestern Somalia prior to USAID's assistance.

^{1/} The difference between rainfall and run-off was not discussed in any project document.

A.1. Ceel Bardaale

At Ceel Bardaale a flood-diversion, or spate, irrigation system was designed and installed in 1966. It was planned that a total of some 15 hectares be irrigated with flood water diverted by 3 masonry structures, all in different togs, one in a major tog and one each in two of its tributaries (see Map No. 3). Some 2,600 meters of canal were completed to convey the diverted water to the fields via a simple system of masonry and wood gates, drops, and turnouts. The fields were divided into roughly leveled bunded basins with adjustable overflow gates. Of the three major structures only one now remains intact, a masonry diversion weir in one of the tributaries which now is totally filled, as is much of its main canal, with alluvial deposits. The weir in the other tributary was breached within the past 6 years. The partial weir, or groyne, diversion in the large tog was damaged in the major rains of 1970 along with its mechanically (hand powered) controlled head gate. All the lesser structures observed seemed serviceable. The scheme continues to function conveying flood waters to some 12 of the original 15 hectares.

Prior to this scheme, there had been some horticultural activity at this site, some citrus trees located in the present expanded grove having been established by means of an engine driven pump drawing water from hand excavated shallow wells in the tog's sandy floor. The development of the diversion scheme did not of itself result in an expansion of the area under citrus production. The nature of citrus fruit tree water requirements is such that the limits of citrus production are dictated by the

capacity to supply water on a fairly regular basis throughout the year. Given the long winter dry season when diversion canals lie empty the constraint to citrus production can be seen to be pumping capacity and/or dry season water availability. Thus, though the area was producing citrus at the time of the USAID assistance, it is not clear what crops Calvin Wixom, the American advisor to the project, foresaw being grown on the newly developed land.

Recent official policy changes regarding the importation and the domestic production and consumption of qaat have profound implications for horticultural production in Ceel Bardaale as elsewhere. The community's high visibility will necessitate its strict adherence to both the spirit and letter of the law and the leadership seems committed to this view. As currently understood the new policy will require the phasing out of all qaat production over the coming 24 months. Economic considerations aside, it is not clear what alternative horticultural crops are technically feasible without supplemental watering. The results of ongoing local attempts at coffee production using only rainfall and diversion irrigation have not been promising. There exist inadequate research findings to at this time suggest that either groundnuts or cowpeas constitute reasonable alternatives. One can only speculate as to the ultimate outcome of the GSDR's efforts to eliminate the profitable qaat production without there being a suitable alternative crop available to local producers.

The permanent labor force for the horticultural crops grown on this scheme consists of approximately 40 men. There exists a great deal of specialization of labor particularly with regard to

nursery and harvesting operations, the qaat generally being harvested by only 3 highly trained men, one of them the camp manager. Occasional peak labor needs, such as for carrying and loading oranges, may require additional labor which will be filled by other community members, sometimes including women. No wages are paid for any of this work. Laborers and skilled workers alike receive identical benefits, as do other community members and apprentices engaged in other agricultural or non-agricultural activities. Though theoretically all community members enjoy equal access to horticultural production for their domestic consumption, clearly the horticultural workers themselves benefit a bit more.

Correctly managed, orange production, harvesting, and sales remain relatively constant throughout the year. Qaat is harvested on a periodic basis 2 to 4 times annually, the number of pickings and total yield depending primarily on rainfall, requiring from 8 to 18 man days of skilled labor per hectare each picking. The preferred system of marketing is to wholesale the production to private traders who come with vehicles to the farm. Alternatively, community trucks transport the produce to wholesale markets, primarily in Hargeysa but reportedly in Djibouti and Mogadishu as well. The recently completed hard-surfaced road from Hargeysa to Gabiley, the latest stage in an ambitious program to improve ground transport throughout the North and into Djibouti, has thus far had little impact on either the Ceel Bardaale community or the Arabsiyo Valley project area. Limited local sales to individuals using animal transport are common, but not economically significant.

The horticultural production at Ceel Bardaale may be characterized as "progressive". Active efforts are made to secure inputs, such as pesticides for citrus production. Knowledge of proper handling, storage, and application techniques of agricultural chemicals seems widespread. Organic materials are pit composted with animal manure to use as fertilizer on qaat. When it was learned that manure directly applied to citrus plantings contained and spread a larval pest which destroyed their roots, a system was devised whereby the manure was added to the irrigation water which effectively distributed the nutrients while controlling the pest. Weeding and cultivation activities appear to be executed in a timely and efficient fashion. Surprisingly the farm manager and workers give the credit for many of the progressive aspects of crop production employed to the Shiikh himself, who is reportedly very knowledgeable in agricultural matters. Ministerial and parastatal sources of inputs and information though limited are exploited skillfully. Over the years several community members have attended MOA farmer training courses.

The value of USAID assistance in Ceel Bardaale may be estimated as having been between U.S. \$200,000 and \$250,000 (in 1966 dollars). In recent times the average current fiscal value of one year's production on the scheme, sixteen years later and with minimal maintenance, approximates the fixed dollar amount of the original investment.

A.2. Arabsiyo Valley

This project's impact on soil and water conservation in the early years after the completion of bunding operations clearly lived up to Wixom's expectations. In the farmers' words, "The bunds stopped the water."

In non-bunded areas, then as now, the irregular but intense rain storms characteristic of northern Somalia caused serious soil losses and gully (arroyo) formation on prime agricultural land. The volume of the rainfall in combination with local topography and the soils' generally poor absorptive capacity, results in severe, if gradual, sheet-wash erosion of the topsoil of the seemingly gentle slopes (largely between 2 and 6 percent) and the erratic but apparently inexorable expansion of the gullies.

The system of bunding introduced to the Arabsiyo Valley (see Appendix) almost totally arrested the loss of soil to sheet-wash erosion by impounding run-off water, the waters' limited burden of soil being deposited behind the bunds. The impounded water eventually percolated into the soil behind the bunds, replenishing groundwater supplies and increasing soil water availability for crop production. Gully formation virtually ceased and the intensity of flooding declined.

Research findings and farmers' reports indicate that Wixom's projection of 100% average increase in cereal crop yields on bunded lands was in fact achieved. However, the team feels that his base production figure of 10 quintals per hectare (qu/ha) of grain sorghum (Sorghum vulgare), the primary cereal crop, to be

an over-estimate. It is more likely that as a result of the bunding operations sorghum production on the average increased from a base of 7 qu/ha to 14 qu/ha, still an enormous achievement.

Within the project area the typical farm was about 10 ha in area of which 3 ha were cultivated. The annual production of such a holding would have increased, then, from 21 qu to 42 qu. Of this production approximately 15 qu was necessary to meet annual domestic consumption needs. Marketable surplus therefore increased from 6 qu to 27 qu, a net gain of 21 qu. At the time of project implementation such yield increases would have led to an increase in the value of a farmer's gross production from \$58.80 to \$117.60, and in his marketable surplus from \$16.80 to \$75.60 (U.S. \$1.00 = 7.14 So. Sh.).

Wixom's calculation of total "acreage benefitted" was based on his description of the USAID assistance as a soil and water conservation project. Accordingly his end of project report which claimed some 5,600 ha as the area "benefitted" (only 58% of the total catchment area) obscured the fact that only some 1270-1870 ha comprised the total "actual" banded area. Production now stands at approximately 150% of pre-project levels and taking the current price of sorghum, SO. Sh. 500/qu (U.S. \$1.00 = So. Sh. 15.1), the value of the ongoing additional annual production from this land will range from \$147,000 to \$217,000. It is clear that the project continues to generate significant benefits to the national economy in light of its overall grain deficit status.

The production of stover for animal fodder, the stalk and leaves remaining after the grain head (panicle) is removed, also increased dramatically as a result of bunding, originally on the order of 50%. It would be difficult to impute a cash value to this production insofar as it appears to have been infrequently traded. Its worth is in its nutritive value to a farmer's own livestock, particularly to draft animals and especially in years of poor grazing; the farmer's need for draft power coming at the very end of the long dry season when natural pasture is scarce and of poor quality and the nutritive requirements of a working animal high.

Income from crop sales is allocated on the following basis: among the highest priorities are clothing and other consumer goods deemed necessities as well as food commodities such as sugar, tea, salt, oil, etc.; next, money will be put aside for the coming crop season, particularly for tractor rental fees; lastly, but significantly, money will be invested in livestock production. In the event that crop income is insufficient to meet a family's priority or emergency needs livestock may be sold to make up the difference. The family also may at harvest time withhold less than its annual food needs from its crop sales in order to maximize its cash income, though this of course entails later purchases of grain from merchants at possibly highly inflated prices.

Early increases in productivity have not been maintained. We estimate that average grain production on banded land stood at 170-200 percent of pre-project levels throughout the first 10 years and 140-170 percent during the following 10 years; average

current yields being 140-160 percent. The nature of the deterioration of the bunds is such that, though over time the project-wide averages have decreased gradually, particular areas, farms, or portions of farms have experienced more precipitous drops in productivity, i.e. project benefits have become less evenly distributed over time. This is due to variations in slope, soils, the specific siting and construction of the bunds, and farmers' maintenance inputs. There is no evidence that the project's continuing benefits have tended to be captured differentially by any one group; however, indirectly those very few individuals who own tractors have made significant gains through renting their equipment to others.

Labor inputs to crop agriculture are specialized along traditional lines: men are almost the sole source of labor. Children may assist in guarding and scaring birds from the maturing standing grain and women may aid in harvesting and threshing. Additional labor may be hired during the early weeding period, such labor being drawn from the immediate agricultural community, e.g. a neighbor's adult, but unmarried, son. The cost of a day's labor is So. Sh. 60-80 plus food, roughly equivalent to the cost of renting a tractor for one hour.

The bunding project in Arabsiyo has had several interesting and apparently unforeseen effects on the local agricultural system. Of these perhaps the most significant is that the bunding seems to have resulted in a marked tendency for farmers to abandon traditional crop rotational systems.

Grain farmers without banded land normally would cultivate only about one third of their total arable holdings. The remaining area would lie fallow, available to their livestock for grazing. After several years of grain production the one third would be idled and permitted to return to native vegetation and another section would be opened to cultivation. Such a system has a long-term positive effect on soil tilth and fertility and leads to soil conservation benefits, as well as having a desirable impact on the control of crop pest populations. Such a rotational system is generally the very basis of a sustainable agriculture, especially given limited modern inputs.

Those farmers who have received bunds on their land have done so only on an average of one third of their arable land and have increased the cropping intensity on this banded portion threefold to a pattern of continuous cereal crops. The generally deleterious effects of continuous cereal cropping have for the most part been counteracted and/or masked over time by the positive effects of increased water availability and the added fertility of the silt deposited by the impounded water. However, with the gradual deterioration of the bunds these positive effects wane. Similarly, the remaining two-thirds of the land are subject to environmental degradation primarily as the result of constant grazing pressure which leads differentially to the destruction of the most economically useful native vegetation and promotes the increase of undesirable and unpalatable plant species.

This pattern of general environmental degradation is, however, not limited to banded lands. One farmer interviewed at Xidhinta, reportedly one of the poorest farmers in the area, owned only two unbanded hectares of land, regularly planting sorghum on only 0.8 ha. While he understood the theory and practice of rotational planting, he was unable to implement it on his own holding due to his own increasing age and infirmity and the poor quality of his oxen. Plowing previously uncultivated land requires higher power and total work inputs. He could not afford to rent a tractor.

This overall pattern is self-reinforcing due to the continuing decline in grazing quality within the general area of cultivation and is exacerbated by the ongoing horizontal expansion of the cultivated area. This expansion includes lands of decreasing crop production potential, which previously had been open for grazing.

The project agreement originally called for labor contributions of the farmers towards bund construction, but was subsequently modified so that farmers' responsibility was limited to bund maintenance. It is not clear what, if any, guidance and training was provided to assist the farmers in this task, or that the project planners had a clear notion themselves of what proper long-term maintenance was either desirable or possible. Maintenance activities provided by the farmers seem to have been limited to early efforts to keep livestock from walking on the bunds and to spotty repair efforts of serious breaches. Over time these activities have come to be neglected.

Proper maintenance activities, designed to prolong the bunds' maximal contribution to soil and water conservation and increased crop yields, would have been more demanding. Given the original design criteria, the natural process of settling and compaction of these earthen dikes combined with the predictable siltation of the area behind the bunds made it a necessity that over time soil be added to the bunds' upper surfaces to enable the continued impoundment of run-off water. Likewise the bunds' arms needed to be extended uphill, raising the level at which water could escape around the ends of the bunds.

Recent studies on agricultural mechanization in the general northwest area have estimated that as much as 85% of the annually cropped area is cultivated by tractor. Our own studies indicate that within the Arabsiyo valley the figure is more on the order of 40%. It would seem that either the higher estimate is in error or that the Arabsiyo valley is an anomaly; we have no evidence to support the latter view. It is clear though that these farmers would like to hire tractors, but they do not have the money to do so. They appear to be encouraged in this desire by the GSDR.

There exists a conflict, however, between the mechanization of cultivation operations and the proper maintenance of the bunds, as defined above. The construction of extensions of the bunds' arms uphill would hamper reasonable access and operation of tractors on banded fields. Interestingly, early bund designs suggested for the World Bank's Northwest Region Agricultural Development Project called for such arms being included in the

original construction phase, a situation which would have made their subsequent maintenance and extension much more likely. For unspecified reasons this facet of their bund design was dropped prior to the beginning of project implementation.

It has become clear to this team that what has been lacking in bunding programs in northwestern Somalia, both in USAID's assistance and subsequent efforts is a long-term, 20-50+ years perspective. Additionally, inadequate attention has been focused on the medium and long-term policy implications of these activities. Particular issues deserving attention include the integration of crop and livestock production, i.e. should agricultural project activities seek to encourage or discourage such behavior and how might they do so. This question is clearly related to the issue of agricultural mechanization - is Somalia in a position to undertake projects which ultimately act to undermine the use and efficiency of animal draft power, by encouraging the use of tractors?

PART III

B. SOCIO-CULTURAL IMPACT ANALYSIS

Most of the rural population of the North West Region can no longer subsist on either cropping or herding alone, with the exception of those pastoral groups who move to the coastal plain in the dry season and who, because of constraints and advantages arising from that fact, have remained mostly pastoral in their activities. The others have seen their pastoral resources reduced as they have lost easy access to the summer pastures south of the disputed Ethiopian border, particularly since 1977. At the same time population shifts from the Harar-Jijiga-Dire Dhabo area into the North West Region has increased competition for pasture, city jobs and even farm land.

Most, if not all, small farmers in the northwest, including those of the Arabsiyo Valley, are part of larger family concerns which integrate herding and cropping activities and often some source of outside cash. The classical pastoral division of labor into two different herding units (nuclear families with goats and sheep, young men with camels and/or cattle) diversifies into three with the addition of a farm, usually owned and operated by a married man with assistance from his wife and children. Camel herds, with the necessary men, move farther south at the beginning of the rains in the typical grazing rotation, but an able-bodied complement, including the married heads of farms, stay behind to plow, plant and complete the major weeding operation; some of these men later go out to help with the herds and some nuclear families will also move with their goats and sheep to summer .

grazing. For a time during the summer the farms and villages are left with a reduced population until harvest. It is the impression of the team that usually women continue to function in farm production as helpers rather than as anything approaching equal partners.

Productive roles in the Ceel Bardaale community are systematized along similar lines. Women are responsible for cooking, housework (men at Ceel Bardaale failed to perceive this initially as work), and young children; these children learn goat and sheep husbandry through casual apprenticeship to the older girls who are in charge of the small stock. Some of these young girls herd the community's stock rather than that of their own families; some of the unmarried men herd community cattle and camels, while others work the communally owned farm areas. This period of men's productive work for the community, before marriage, was described by several community members as "training" -- a perception highly consonant with the initiation aspect of traditional camel-herding done by young men. When the male farm workers marry they often move onto their own production of crops and stock, and feeding their own families while continuing to depend on the community to fulfill special needs (emergency medical care, for example) and continuing to participate in community affairs. Many members of the community continue transhumance as necessary; some live in cities or abroad.

STATUS AND PARTICIPATION OF BENEFICIARIES IN LOCAL ECONOMIC AND
POLITICAL BODIES.

Arabsiyo Area: Before the project began, ministry representatives visited small groups in the proposed site areas, which at that time included Arabsiyo itself, Teysa and Xidhinta. They explained the project and sought cooperation and participation from the farmers. It seems that at that time [Frank J. Mahoney, USAID/Mogadishu, dittoed n.d. -- The Soil and Water Conservation Project in the Northern Regions of the Somali Republic] Arabsiyo people thought work was to be begun simultaneously at both ends of the valley. Initial operations actually were confined to the Xidhinta and Teysa areas, one purpose of the project being to conserve soil and water resources and stabilize gullies. The team surmises that project staff talked farmers into accepting bunding by de-emphasizing conservation arguments and placing heavy emphasis on increases in their individual crop yields. Arabsiyo farmers were disappointed and resentful; whether coincidentally or as a result of their disappointment, a rumor began that the bunding at Teysa and Xidhinta (initially done across farm boundaries and grazing areas) was a precursor to government expropriation of the farmers' land. Individual farmers resisted and minor acts of violence occurred between farmers and tractor drivers. Elders, officials, and "informed persons from Hargeysa with relatives in the Teysa area" had to be mobilized to calm the fears before the work could proceed. It can certainly be concluded that community participation in planning was wholly insignificant, to the extent that the target communities were misinformed.

Some community desires were incorporated into implementation, however: in response both to suspicion about government motives and fears that individual farmers might encroach on each other's land, later bunds were built within the confines of individual farm boundaries. In response to petitions from local groups, bulldozers and drivers were detailed to improve several local open watering ponds (wars). However, though the farmers also petitioned that the tractors be used to plow the dense subsoil left behind new bunds (claiming their oxen were too weak at the end of the dry season to break it up), and Mahoney's report urged that this be done, no indication is given in later project documentation that it was done.

Commitment of resources by the community to project work was negligible, despite the initial project agreement which stated that farmers with oxen would build one bund for every three which the bulldozers did. This requirement quickly showed itself to be quixotic and was simply dropped. Labor input was therefore minimal - individual farmers would help holding the stadia rod for surveyors when work was being done on their own land; wives contributed to the extent of preparing drivers' meals. The fact that the unrealistic initial requirement was dropped when difficulties were encountered undoubtedly furthered the development of what the impact evaluation team dubbed the "tractor mentality" which we found prominent in the area: bunding can only be done with bulldozers (the bigger the better). We question whether the project would have had a greater "spread effect" if small tractors

only, or even simpler technology, had been used. Interviews suggested that the few individual farmers who subsequently copied the technique on their own farms were the wealthier who were able to satisfy the "tractor mentality", thus contributing to the notion that the rich can help themselves, but the everyone else must wait for outside largesse.

Beyond that probable effect, no major identifiable impact was found to have occurred on the relative social status of individuals within the banded communities, nor on the role or degree of participation of women and children.

It should be noted that two sites near Arabsiyo received respectively a diversion irrigation system, and a dam with a piped gravity irrigation arrangement. The team was unable to determine why this unplanned work had been done on two individuals' farms outside the project area.

It could not be discerned whether project implementation had any major impact on the status and participation of the banded communities in terms of changed access to, or influence in, other local bodies; the extent of their access seems to be far more determined by their favorable location -- near the regional capital of Hargeysa, and, then as now, on roads of the best quality in the area.

Ceel Bardaale Community: This religious community was founded about the time of Somalia's independence (1960) by the charismatic Shiikh Maxammad Raage. A refugee from the Harar area of eastern Ethiopia, he organized with his followers, many of them also refugees,

a cooperative which was based initially in Tog Wajaale at the provisional boundary between Somalia and Ethiopia in what is now Wagooyi Galbeed region (North West). In 1961 a small group of members, mostly young people, followed the Shiikh to the Ceel Bardaale area northeast of Tog Wajaale and, on the basis of a negotiated agreement with the pastoral groups of that area, established a small settlement along lines described by English-speaking members as an "Islamic cooperative". Interviewees who accompanied the Shiikh at that time described the early days as characterized by a pioneering spirit of self-help (the community is still very proud of the road it built, mostly by manual labor, through a rocky pass), and a flexibility of roles which had young women fetching, carrying, and in some cases working shoulder to shoulder with the men. At the time the AID diversion and bunding work was done (1966) two small settlements existed -- Ceel Bardaale proper ("camp" -- or in Somali, gayb -- number one) and Boodhka ("camp" number two, where the scheme was done) and the principle of communal farming and herding was well established. A third settlement (Kawneen) was then being developed, and the community was beginning to experience difficulty with the local pastoralists who (as seems likely) found this ambitious expansion to be more than they had bargained for when they initially ceded settlement rights. Elderly female interviewees described the project period eloquently: "Wixom barwaaquu ahaa" (approximately, "Wixom brought abundance") and added that the increased security which the project work brought stimulated many marriages and the beginning of truly

settled community life. One woman commented that the development and growth of the community had caused the pioneering flush to wear off, so that people could settle back into traditional role patterns; women left off working beside the men after that, since they had to take on traditional household duties. And, despite ringing declarations of women's full participation in community labors on the farms, the team observed if anything a more complete differentiation of work roles into traditional patterns, than was the case in the Arabsiyo area; very likely this results from the religious thrust of community life.

Though four women (out of a total of seven) were listed in 1974 as members of the central policy committee (guddida sare) of the cooperative and one of the community's most able spokesmen insisted they still function as committee members, his description of their functions ("training" other women to cook, weave mats, etc.) only confirmed the team's sense that participation of women in community decision-making is marginal. Certainly AID's project work had not the slightest positive impact on women's status and participation; indeed, by giving the community techniques to expand and solidify its tenure, the project may have indirectly contributed to the loss of that early pioneering spirit which, for a time, apparently introduced some flexibility into role patterns, and which might have taken deeper root had the community not expanded so fast.

In marked contrast to how the project began at Arabsiyo, influential members of the Ceel Bardaale group initiated discussions with project staff and ministry officials and played

a major role in the decision to locate the project at Ceel Bardaale, and very possibly in determining the overall nature of the project itself. They also facilitated implementation in a number of ways. A commitment of community resources--chiefly labor and storage facilities--was met to the best of the community's ability, despite the fact that in 1966 "the unusually dry season caused many people to go to the interior with their animals, who would have normally stayed and been available for intermittent labor". However, the Shiikh did "his best to maintain a labor force of 25-30 men". [Wixom letter to Director USAID/Mogadishu, 14 September 1966.]

The Shiikh and other leaders pushed hard to get the USAID work extended to the community lands they were opening up around Kawneen (interviewees told the team that the Boodhka site was unsatisfactory, ^{the best} but/the community had access to at the time). This effort failed, but with its own resources the community eventually deployed bulldozers to complete a diversion channel at Kawneen in 1970 as well as building still others later on. "Laga bari, laga badi" (the student outdoes the teacher) remarked the Shiikh's son smugly-- they claim their own canal work is more satisfactory than the USAID scheme, and what we saw of their later work has certainly been more devoutly maintained.

Post-project impacts include that, within the community, the initial and follow-up diversion schemes expanded the area under cultivation and thereby encouraged the growth of an effective management hierarchy in production, though not necessarily in other areas of community decision-making. (But it should be noted

that religious communities in Somalia tend generally toward more hierarchy in social structure than do normal communities.)

Within the context of an unusually enterprising religious community, it seems clear that the project also helped to enhance the image of Ceel Bardaale region-wide, as a model for local development. Village elders from other areas visited both for spiritual guidance and to observe the group's development activities [Wixom same letter]. By the project's termination, requests for similar aid were coming in from all over the then Northern Region. Even as late as 1980-81, one team heard frequent admiring references in Mogadishu and Washington to "the Ceel Bardaale self-help water spreading scheme in which no foreign assistance had been involved," clearly a somewhat selective reference to the additional diversion channels constructed by the community into the early 1970s.

As noted above, local pastoralists disputed the community's right to develop the Kawneen settlement (#3), but as Wixom /30 April 1966 / notes, during the project period "all government officials" came to be "in agreement that the Shiikh has a right to develop the area". It is a reasonable supposition, though not a documented fact, that the community's active links with the outside and specifically to the American project, contributed somewhat to this governmental change of heart, while undoubtedly the relative size and permanence of the structures themselves have enhanced the community's claim to the developed areas. Moreover, the team finds it likely that the project itself and the community's contacts with a powerful outside agency (USAID) enabled it to negotiate for other outside

assistance, at least for a period, with increased effectiveness.

Access to Health, Nutrition and Education

The team surveyed health services, nutrition and education in the Arabsiyo and Ceel Bardaale areas and concluded that the USAID projects had no observable direct impact on the communities' access to these resources. Indirectly, however, American involvement in Ceel Bardaale may have been a factor in Peace Corps' decision to aid with the self-help construction of an elementary school building during the implementation of the irrigation scheme. But the level and kind of government health services and educational inputs to these communities seemed wholly consistent with patterns in other parts of North West Region, then as now.

With regard to nutrition, despite the expansion of fruit and vegetable production in both project areas - not, however directly attributable to project work - there has been no significant change at all in farm families' tastes in food or the composition of their diets, despite their easy direct access to their own horticultural production, except on the rare occasions when a farmer or laborer will eat something "off the tree" in the fields. Horticultural production is viewed almost exclusively as a cash crop.

Sheer quantity of basic foodstuffs is a seasonal problem in Somalia. One might have hoped that the increased production of sorghum and maize which bunding brought about, might have helped families to avoid the periods of traditional food deficiency, after long dry seasons or during major droughts. But it is the team's strong impression that in the Arabsiyo area seasonal scarcity continues to occur; government policy, the desire to maximize

cash income, and social pressures to distribute resources within the family, make storage of large amounts of grain difficult.

At Ceel Bardaale supply seems more constant. However, this is undoubtedly due to the unusual degree of coordination and planning among the fourteen distinct settlements which comprise this unique community, rather than to specific technical inputs. The team also noted that the people of Ceel Bardaale seemed more confident of their rights and access to health care for major emergencies than did the people of Arabsiyo; several people stated that in case of a serious health problem their executive committee member (madax degmada, or - approximately - "headman") would see that they got necessary cash or transport. Again, however, this differential seems due to the nature of the community rather than to USAID or any other "outside inputs."

PART III

C. INSTITUTIONAL IMPACT ANALYSIS

One Arabsiyo project goal which was not achieved was the creation of a Soil and Water Conservation Department in the Ministry of Agriculture. The Technical Assistance Project History and Analysis report that Wixom wrote near the end of the project provides some hints that he thought the physical accomplishments would so clearly establish the benefits of the Department that they "might very well lead to the establishment of a Conservation Department within the local Ministry of Agriculture".

It did not, and had not, resulted in such a department by the time the impact evaluation was conducted 17 years later. In 1979, those portions of the Ministry for Agriculture, the Ministry for Livestock and the Department of Natural Resources responsible for water resources were reorganized into the Ministry for Minerals and Water. There is no section for soil and water conservation there either. The Ministry of Agriculture still works with irrigation but only in southern Somalia. The agricultural training officer for the Northern region at Aburiin deals with dryland farming. From the limited evidence available, the team concluded that the creation of a new bureaucratic entity for soils and water conservation required the attention of the Mogadishu authorities and was beyond the capability of the project to achieve. The evidence indicated that this objective of the project had not been seriously pursued with the central government.

Irrespective of the creation of a separate soil and water conservation entity, the Ministry of Agriculture had agreed to continue the bunding work at Arabsiyo after the USAID portion of

the project was terminated. The equipment remained and the project staff was to have continued bunding in the Arabsiyo Valley. However the Ministry lacked the resources to continue the bunding. Although the government did not have the resources to continue bunding on their own, bunding has remained a continuing activity in the northwest. There is evidence that some farmers have hired tractors and had bunding done privately although these cases are clearly limited in numbers.

The continuance of the AID-assisted project activities at Ceel Bardaale was not a responsibility of the government but of the community itself. The community learned the diversion dam/canal techniques from Wixom's demonstration work and used these later to construct flood irrigation schemes at four other sites. Some aspects of this work have been more successful than others but the considerable expansion in crop and citrus areas made possible at these four settlements are clear indications of the successful transfer of flood irrigation techniques under the project.

The benefits from the bunds built during the project have been sustained, although, over the ensuing seventeen years, as one might expect, at reduced levels of effectiveness because of silting and damage to the bunds caused by livestock. These continued benefits at Arabsiyo and those derived from Ceel Bardaale suggest that the nature of A.I.D.'s interventions at each location fit very well into their differing socio-organization structures.

At Arabsiyo, considerable benefits were gained with minimal maintenance and with no dependency on outside resources which the evidence suggests were actually available on only an intermittent basis. The project did help foster a demand for tractors that

proved to be much greater than could be met by the Somali government's parastatals which were created to provide them or, later, by the private sector. A German project in the late 60s and early 70s provided tractors without charge and undoubtedly also helped fuel the demand. A common complaint heard was the difficulty keeping tractors operable because of the lack of spare parts for the Massey Ferguson and Fiat tractors which predominate in the area.

At Ceel Bardaale, the nature of the community, a hierarchical management structure (highly developed work ethic and cooperative spirit) provides organizational structure needed to successfully build, operate and maintain flood irrigation structures. The inherent characteristics of flood irrigation require organized cooperation at peak periods, not only to provide the optimum level of benefits but to protect the structures themselves. Successful management of this type of irrigation allowed the community to benefit from high value cash crops such as oranges and qaat.

In retrospect the community recognizes, and the team concurs, that the site selected for this project was far from ideal. At the time of its inception, however, no more appropriate site was available to the community for similar development efforts. Subsequently other sites, better adapted to diversion irrigation application, became available for development. This helps to account for the observed lack of proper maintenance activities for the scheme's structures and canals; it was decided to invest capital and labor inputs horizontally, in the development of new schemes using the knowledge and techniques learned from USAID's assistance. Though this decision was based to an extent on valid

though intuitive economic reasoning, other non-economic factors were likely at play as well, particularly the desire to geographically expand the community's agricultural schemes for social and political reasons.

A major achievement helping to maximize the organization and management of the Northwest Soil and Water Conservation project was the continuity of its U.S. technical assistance. Calvin Wixom was the Project Manager throughout the life of the project. Although his first implementation priority was on getting structures built, there is evidence that he interacted with local leaders and farmers to be responsive to community requests for changes, at least in Arabsiyo, and at the same time managed to keep the originally scheduled work moving forward.

Similarly, at Ceel Baradaale, the continuity in leadership provided by Shiikh Maxammad Raage has been a key factor in assuring the successful replication of technological innovations which AID introduced 20 years ago.

C.1. Strategy and Policy

The inevitability of recurring drought has affected the behavior of the farmer and the behavior of the government. Both have developed strategies for surviving the lean years.

The farmer's strategy is based on diversification, i.e., combining crop and livestock production. However, separate ministries are responsible for these activities and their lack of coordination and outreach makes it difficult for the farmer to take advantage of whatever services might be available. Even were this not the case, the farmer relying on rainfall would find agricultural services, unless highly subsidized, unaffordable. The one input which is subsidized, and which farmers reported they did use, was tractors provided by the Farm Machinery and Agricultural Services Organization (ONAT) at a rate two thirds of the agency's operating costs. With the minimal and erratic rains, periodic crop failures are inevitable making the use of purchased inputs a poor investment for the subsistence oriented farmer.

All of Somalia's agricultural chemical input needs are imported and until recently the government, through semi-autonomous organizations, has been the sole distributor. Recent actions to reduce budgetary expenditures have made it very difficult for the government to continue its policy of subsidizing agricultural inputs. Even prior to the recent currency devaluations, inputs were consistently in short supply.

The limited inputs being imported barely covered the needs of the state farms and development projects which it appears received first priority in their allocation. This priority grew out of the government's strategy for dealing with the effects of

the lean drought years after the government made food security a high priority policy. This led the government into favoring large-scale over small-scale agriculture in hopes of achieving rapid production increases. Between 1975 and 1981, more than 45% of agricultural investments went to state farms and, accordingly, agricultural research was concentrated on large-scale, irrigated state farms. Government distribution priorities were undoubtedly also affected by the knowledge that the organizations responsible for input distribution lacked the institutional capacity to distribute to individual farmers.

At the time of the AID project, the government played a minor role in marketing grains. Later, in trying to achieve self-sufficiency in food, particularly maize and and sorghum, the Government pursued policies designed to achieve more control over surplus production. Farmers were legally limited to keeping 100 kg of their grain harvest per family member each year. From 1971 until 1981, they were required to sell their surplus at the fixed price to the Agricultural Development Corporation (ADC), the government marketing monopoly. While the government pursued a consumer oriented low price policy, the producer price remained the same throughout the seventies irrespective of quality despite significant inflation. As a result, a considerable difference developed between the fixed price and the ^{price} / on the parallel free market, particularly after substantial amounts of food were imported following the 1973-1975 drought. By 1980 producers only sold to ADC as a last resort. Recently, the government has been de-emphasizing the role of semi-autonomous organizations such as ADC, and for the past

year free market prices have prevailed. The team was unable to assess the effects this significant change has had in the northwest.

Another government policy encouraged the creation of agricultural cooperatives. The potential advantages of cooperatives status were that a cooperative could have access to more than 100 hectares of land. Funds for development of the cooperative were available from both the Ministry of Agriculture and through bank loans guaranteed by the government. The Ceel Bardaale community has apparently applied for, but not received, cooperative status.

Related to the government's emphasis on increased food security was the decision to make the importation, production and consumption of qaat, a mild stimulant, illegal. During the team's fieldwork the government announced that production of qaat would be phased out in 24 months largely because qaat production occupies large areas of agricultural land better used for food production. If this policy is effectively carried out it will have a major impact on the income of the Northwest farmer for whom qaat is the dominant cash crop.

The title to all land is held by the Somali Government; the Ministry of Agriculture is responsible for certifying a farmer's right to use the land he occupies. As the Ministry has not proceeded very far in providing these certifications, in actuality land is held, bought and sold much as it was during the 1960s, - that is, as though the farmer actually held title. The government's legal title to land can be an important instrument in enforcing government agricultural policies, although it may act as a major deterrent to farmer credit.

C.2. Training

According to the 1966 Technical Assistance Project History and Analysis Report: "During the period of the life of this project, an average of 15 Somalis received on-the-job training in various conservation activities including engineering, construction techniques, tractor and vehicle operation: maintenance, property management, record keeping.

In addition to on-the-job training, five people were sent to the U.S. for five months of soil conservation training. On their return, four were supposed to be assigned to Hargeysa the Northern Region. Only one was in fact assigned there serving as project manager and counterpart technician for the last years of the project. Subsequently he managed the agricultural training center for the area and was the district coordinator for agriculture at Gabiley.

Much of this training, particularly in equipment operation, occurred in the early days of the project at Arabsiyo trained staff moving to Ceel Bardaale when work began there. The limited duration of work at Ceel Bardaale would have made further training difficult as the primary focus was on early completion of the structures. Community members reported that any training which occurred was "unintentional" but community members observed and participated in the activities and learned from them.

PART IV

SUMMARY: FINDINGS AND LESSONS LEARNED

PROJECT FINDINGS

The soil conservation objectives of the Arabsiyo project were met and continue to have an effective impact. Compared to unbunded areas, the original bunds continue to significantly retard the loss of top soil though with less effect than in the first years after construction. The bunds continue to arrest the advance of gullies. With respect to crop production objectives, yields at Arabsiyo achieved the 100% targeted increase and production in the 1270-1870 hectares of banded areas now stands at approximately 150% of pre-project levels. In terms of value, annual production from this land will range from \$147,000 to \$217,000, a significant contribution to Somalia's food self-sufficiency needs. At the same time, it is interesting to note that the team concluded that while banded area yields at Arabsiyo increased 70 to 100% for the first ten years following the project, yields fell to a 40 to 70% increase during the second ten years. Using the hypothetical case presented in the Analysis section, the average annual value of a farmer's production should have increased from \$58.80 to \$117.60, and his marketable surplus from \$16.80 to \$75.00. The project objective to establish a separate Soil and Water Conservation Agency was not realized, nor was the team able to find any evidence that its establishment was a matter of serious negotiation during the life of the project or since. Despite this failure to develop the Agency, the team concludes that benefits from the work done under the project were sustained

and did serve as a model for subsequent activities, both public and private. In the case of Arabsiyo, this was evidenced by the follow-on bunding activities of the FAO in the area several years later, as well as the current World Bank Northwest Region Agricultural project. At Ceel Bardaale, the community constructed four additional diversion schemes drawing from the USAID demonstration model.

Project objectives for Ceel Bardaale sought a 15 hectares increase in land area suitable for growing horticultural cash crops. The area was to be irrigated by flood water diverted by 3 masonry structures, all in different togs (rivers). Only one of the 3 structures remains intact, although lesser structures in the diversion scheme appeared serviceable. Nevertheless, the scheme continues to convey flood waters to an estimated 12 of the original 15 hectares constructed. The average current annual value of production on the scheme approximates the estimated \$200,000 to \$250,000 original A.I.D. investment.

With respect to maintenance of the AID structures, the team concludes that there has not been proper maintenance of the bunds at Arabsiyo. It is also not clear to the team, however, what, if any, guidance for maintenance was provided to farmers, nor is it clear that project planners knew what long-term maintenance was possible or desirable. Regarding Ceel Bardaale, the team agrees with the community's decision to place its resources into the construction of additional diversion schemes at better sites than the site that was selected for AID's scheme, rather than applying these resources to repairing the A.I.D. scheme.

The inadequate supply of agricultural inputs, notably pesticides and improved seeds, has been a major barrier to increased production in the northwest. The team concludes, however, that the project did not improve farmer access to these inputs. It did, however, help instill a farmer preference for mechanized means to construct bunds, rather than the traditional oxen, that would be very difficult to overcome. The project also helped foster a demand for tractors for plowing that the parastatals created to provide them, as well as the private sector more recently, have been unable to meet.

With respect to health, education and nutritional services, the team concludes that the project had no observable impact on these services at either Arabsiyo or Ceel Bardaale. There has been no evidence of significant change in family diets despite the expansion of fruit and vegetable production in both project areas.

The project has not changed the role of women. Environmental concerns have, of course, been addressed through the bunding at Arabsiyo, but did not receive any significant attention at Ceel Bardaale.

The team came to recognize the importance of foreign remittances, particularly from the Gulf states, to the region's economy but found no evidence that any significant amounts were going into agriculture.

LESSONS LEARNED

The projects selected for Arabsiyo and Ceel Bardaale were entirely appropriate for the social organization that prevailed in each area. The diversion scheme for Ceel Bardaale required a highly developed work ethic and cooperative spirit to build, operate and maintain the flood irrigation structures and these the community provided. Arabsiyo, on the other hand, provided no social organizational structure similar to that at Ceel Bardaale, so that bunding which does not depend on community cooperation and requires minimal maintenance was entirely appropriate there.

The two projects evaluated here support the idea that projects undertaken without involvement in the form of financial, planning, or labor contributions on the part of the beneficiaries decrease the likelihood that they will be able or willing to commit capital and non-capital resources for non-traditional purposes, such as maintenance and/or replication.

A long-term, 20-50+ year perspective to future bunding efforts is needed to focus attention on the medium and long-term policy implications of bunding. LDC governments and donors alike need to consider such issues as the integration of livestock and crop production, as well as the affordability of agricultural mechanization vs. animal power.