PHILIPPINE GEOGRAPHICAL JOURNAL

VOLUME XVI April-May-June, 1972 NO. 2

ARTICLES

PUBLISHED QUARTERLY BY
The PHILIPPINE GEOGRAPHICAL SOCIETY
MANILA, PHILIPPINES

The PHILIPPINE GEOGRAPHICAL JOURNAL

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Editorial:

THE REPUBLIC OF THE PHILIPPINES IN THE INTERNATIONAL GEOGRAPHICAL UNION

The Republic of the Philippines is a member of the International Geographical Union. Historically, the membership of the Republic of the Philippines (RP) to the International Geographical Union (IGU) was conceived as early as 9 September 1966, when Professor Shiba P. Chatterjee, the first Asian to assume the presidency of the IGU, visited the Philippines and took time out with Dr. Juan Salcedo, Jr., then Chairman of the National Science Development Board to discuss the possibility of having the Republic of the Philippines enrolled as a member of the IGU. Dr. Juan Salcedo, Jr. and Prof. Chatterjee agreed in principle that for the RP to become a member to the IGU a certain institution, perhaps the National Research Council of the Philippines (NRCP) or the National Science Development Board (NSDB) should be named as the adhering body to the IGU.

Prof. Chatterjee, not contented with the previous conversation in Manila, wrote Dr. Juan Salcedo, Jr. in his capacity as Chairman of the NRCP on 25 October 1966 and reminded the latter regarding the question of membership of the RP to the IGU.

In fairness to the Philippine Geographical Society (PGS), it must be stated, however, that the IGU had first extented the invitation to the PGS to join that prestigious international geographical body.

Prof. Dominador Z. Rosell, himself a geographer in his own right, in his capacity then as Supervising Scientist and Chief of the Division of Agriculture and Natural Resources Research (DANRR) of the National Science Development Board (NSDB) writing on 17 May 1967 to Dr. Salcedo, Jr. as Chairman of the NSDB recalled the events when Prof. Chatterjee invited the RP to become a member of the IGU.

On 5 March 1968 the NSDB Governing Board adopted resolution NSDB R. 6 authorizing the Chairman to enlist the Republic of the Philippines as member of the IGU with NSDB as the adhering organ-

ization, and further authorizing the NSDB Chairman to create a committee composed of NSDB personnel and representatives of other government and private agencies or entities. This Committee shall serve as the national working and advisory body of the NSDB in the promotion of geographical sciences and act as liaison to the IGU. Thus, 1968 is a very memorable year to the Republic of the Philippines for it marked her entry to this world body concerned with the promotion of the broad subject of geographic sciences. On 8 July 1968, the Secretary-General and Treasurer of the IGU acknowledged receipt of NSDB first payment of membership fee. On 24 July 1968, NSDB Office Order No. 013 was issued creating the National Committee on Earth Sciences with Section on Geography and designating Prof. Domiador Z. Rossell and Mr. Jose O. Jaug as organizing Chairman and Secretary, respectively.

On 21 February, 1969, the NSDB approved the resolution renaming the National Committee on Earth Sciences to National Committee on Geographical Sciences. Under this amended office order, the NCGS is now composed of twelve (12) members from various disciplines of geography represented by the member agencies. The Philippines, through the NSDB-NCGS, is slowly and effectively making geography one of the tools in the attainment of economic growth and development.

During the IGU Congress held in India, the Philippines was not represented, although invited. A technical paper was sent which was accepted by the IGU and formed part of the Congress document.

On the occasion of the 22nd International Geographical Congress to be held in Montreal, Canada on August 10-17, the Philippines will be ably represented by Prof. Dominador Z. Rosell and Dr. Domingo C. Salita, Chairman and Vice-Chairman, respectively, of the National Committee on Geographical Sciences, NSDB. Prof. Rosell is a professorial lecturer on Economic Geography at the Philippine Women's University while Dr. Salita is Chairman, Department of Geology and Geography, University of the Philippines.

Neither the *Society* nor the *Journal* assumes responsibility for the statements of fact or opinion by authors.

The *Philippine Geographical Journal* is published quarterly by the Philippine Geographical Society at Manila, Philippines and is sent to all members.

The subscription rate in the Philippines is P5.00 a year; foreign is $5.00 U.S.; single copies (regular issues) P1.25; foreign is $1.25 U.S. Make all remittances payable to the *Philippine Geographical Journal*.

Editorial correspondence should be addressed to The Editor-in-Chief, *Philippine Geographical Journal*, c/o Bureau of Soils, P. O. Box 1848, Manila, Philippines.

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Re-entered as second-class mail permit at the Manila Post Office on July 5, 1963.

EFFECTS OF 2-CHLOROETHYLPHOSPHONIC ACID ON SOME PHILIPPINE HORTICULTURAL CROPS

by

N. D. BONDAD[1]

CEPA (also known as 2-chloroethylphosphonic acid, Ethrel, ethephone, 2-chloroethanephosphonic acid, Amchem 66-329, etc.) is a plant growth regulator which produces many physiological effects on plant tissues similar to ethylene (Amchem, 1969). It was first mentioned in the literature in 1967 (AMCHEM, 1967; NG, 1967; WARNER and LEOPOLD, 1967) and has since been the subject of investigations by horticulturists and plant physiologists in various parts of the world. There is an increasing volume of reports showing the numerous and varied effects of CEPA on plant growth and development. The available information to date suggests that ethylene, one of the breakdown products of CEPA (COOKE and RANDALL, 1968; WARNER and LEOPOLD, 1969; YANG, 1969), is responsible for the biological activity of the compound.

Most of the responses of Philippine-grown crops to CEPA are yet unpublished and those published have appeared in Philippine journals of limited circulation. An attempt is therefore made to consolidate the information available to the author for the benefit of a wider reader. For a world-wide review of the potential uses of CEPA on agricultural crops, the article of WILDE (1971) should be consulted.

OFF-SEASON FLOWER INDUCTION

Mango. — The two commercially important cvs. of Philippine mango, 'Piko' and 'Carabao,' have a highly seasonal flowering habit. Under certain conditions, flowering is also biennial, blooming profusely in one year and sparsely, if any, the next year (JAMIAS, 1971; SINGH, 1960). To induce earlier and improve flowering growers build smoky fires generally below the trees and allow the dense smoke to pass through the foliage. This practice, known as smudging, has been reported to induce off-season flowering (GONZALES, 1923). Flowering in response to smudging may be due to ethylene gas, a flower-inducing agent in pineapple (BURG and BURG, 1966; COLLINS, 1960), present in the smoke

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emanated by smudging materials (PANTASTICO and MENDOZA, 1970). Flower induction with CEPA is an excellent means of testing the above assumption since it is well documented that CEPA releases ethylene in plant tissues (COOKE and RANDALL, 1968; WARNER and LEOPOLD, 1969; YANG, 1969).

As early as 1968, MANUEL, *et al.* (1971) noted that CEPA promotes an off-season flower bud formation and defoliation of the 'Carabao' mango. Later studies by the same workers (MANUEL, *et al.* 1971) confirmed the above findings and further observed that spray applications of 500 to 1000 ppm were effective on inducing flowering but moderate to severe defoliation occurred. At 500 ppm, there were cases of flower induction without defoliation but the degree of flowering was lower than at 1000 ppm. BARBA (personal communication, 1971) found that 250 ppm was not effective on flower forcing and 1000 to 2000 ppm caused defoliation. Trees treated twice with 500 ppm produced flowers with minimal defoliation. In another report (DUTCHER *et al.*, 1971) it was found that weekly or twice monthly spray applications of 125 to 250 ppm CEPA for one-month resulted in flowering within six weeks after the initial treatment (table 1).

Pineapple. — Pineapple is a short day plant that normally flowers during the months of November and December (VALMAYOR *et al.*, 1970) but in some instances may also flower any time of the year (BONDAD, unpubl. 1971). Ripe fruits flood the market 4.5 months later with prices sometimes dropping below production costs (VALMAYOR *et al.*, 1970). In canning companies pineapple fruits are made available the whole year round by forcing the plants to flower with ethylene gas (Philippine Packing Corporation, personal communication, 1971). Saturated solution of calcium carbide (*carburo*), which releases acetylene gas upon reaction with water, is recommended for small growers because it is cheap, readily available and easily applied (VALMAYOR *et al.*, 1970). However, farmers have reported abnormalities of fruits even at the recommended rate of 50 ml/plant of 100 g/l solution applied to the heart.

Tests with CEPA show that 15 month old 'Smooth Cayeene' plants can be forced to flower earlier than the normal flowering season (BONDAD, unpubl., 1971). Prior to the appearance of the flower buds and until the development of fruits, the leaves of plants treated with 2500 and 5000 ppm spread apart while the control remained erect. At both concentrations no slips were formed and the fruits had very small or no crown at all. In a commercial scale trial, as high as 85 percent induction was observed 80 days after treatment at which time the control remained vegetative. Immature plants were also induced to flower by 1000 ppm CEPA with very small resulting fruits (table 2). MANUEL (unpubl., 1970) observed the same effects of CEPA on immature and mature plants but further noted the formation of "vegetative flowers"; i.e. crowns without fruits borne at the heart of the plant.

CONCENTRATING MATURITY

Tomato. — Picking tomatoes as they ripen on the plant is costly and time consuming and it prevents the maximum utilization of land due to the prolonged growing season. Thus it is necessary that such fruits mature and ripen all at the same time. The practical significance of concentrating maturity and ripening is much more realized in developed countries where mechanical harvesters cut the plant and pick the fruits regardless of maturity.

Preharvest spray application of 250 ppm CEPA hastened the maturity and ripening of both immature and mature '2029' tomato fruits (BONDAD, 1970a; 1970b). A concentration of 500 ppm resulted in the dropping of flowers but not in fruit or leaf abscission. Slight increases in total soluble solids were also observed in fruits of sprayed plants. Under field and pot conditions, 400 ppm CEPA hastened the ripening of '2029' tomato fruits sprayed at the mature-green stage but the treatment induced flower abscission and lowered the percentage germination of seeds (MAMICPIC and BUCAD, 1971).

Coffee. — Hand-picking of ripe coffee berries while leaving the green ones until they turn red (priming) is a laborious and costly operation and gives the harvester a larger share as the process is repeated on the remaining berries (CABANAWAN, 1971). Thus similar to tomatoes, it is desirable to concentrate fruit ripening into a few peak periods to reduce the number and cost of harvesting operations.

Excelsa coffee berries sprayed once with 200 ppm CEPA two weeks before harvesting produced 90 percent ripe berries one week after treatment (CABANAWAN, 1971). Higher concentrations accelerated the rate of ripening faster than lower concentrations but the former caused abortion of beans and yellowing and abscission of leaves, especially at 800 ppm. With Liberica, single applications of 100 to 800 ppm CEPA hastened ripening without affecting the gross character of the berries (NAMUCO, 1972). The effectivity of the treatment increased with increasing concentration of CEPA and advancing stage of maturity of the berries. The best concentration appeared to be 100 ppm applied 6 weeks before 100 percent natural ripening.

POSTHARVEST RIPENING AND DEGREENING

Banana. — Acetylene gas generated from calcium carbide-water reaction is used by local fruit brokers as an aid for a faster and uniform ripening of banana fruits. There is a common and widespread belief that fruits treated with calcium carbide are poor in quality (BONDAD *et al.*, 1970) but a number of workers (CHIOCO and CABALONA, n. d.; SMOCK *et al.*, 1967) have indicated that immaturity and not calcium carbide is responsible for the poor eating quality of treated fruits.

In attempts to look for other ripening stimulants, CEPA was found to be very effective on the ripening of 'Lakatan' (a Philippine cv. different from 'Lacatan' of Central America) bananas (BONDAD, 1971; BONDAD *et al.*, 1970). At 2500 and 5000 ppm, the onset and magnitude of the climacteric was earlier and higher in treated than control fruits stored at 66 to 70°F or 76 to 80°F. Complete color development was attained within five days after color break, regardless of the ripen-

ing temperature or concentration of CEPA used. Even immature fruits (below "three full quarters") ripened with normal color and taste four days after dipping in 2000 ppm solution (TAGIUAMON, 1971). The ripening of 'Saba', 'Latundan', and 'Leines' have also been accelerated by post-harvest dipping in 1000 ppm CEPA with "hands" and "fingers" having about the same response to CEPA. In a study of different ripening methods BONDAD *et al.* (1972) obtained ripe fruits within 48 hours after spraying "fingers", "hands", or bunches to run-off with 2500 or 5000 ppm CEPA.

Citrus. — Native citrus fruits remain green even when fully mature. It is common knowledge that some citrus varieties command a better price when degreened and, therefore, the practical value of degreening is obvious.

CEPA at 2500 ppm induced the formation of a bright yellow-orange color in 'Ladu' mandarin and 'Valencia' orange dipped for five minutes and degreened at 70°F (BONDAD and MENDOZA, 1972). Five to six days was required to completely degreen the 'Ladu' and seven to 12 days for the 'Valencia'. With 'Szinkom', fruits dipped in 1000 ppm CEPA for two minutes were fully yellow within four days without significant changes in total soluble solids or titratable acidity (table 3). A concentration of 2500 ppm and dipping time of five minutes tended to delay degreening (BONDAD and MENDOZA, 1972).

Mango. — Mature-green fruits of the 'Carabao' cv. dipped in 500 to 8000 ppm CEPA for two minutes then wrapped in perforated (four holes, five mm diam.) polyetheylene bags (1.5 mils, 10 × 12 in.) did not ripen satisfactorily (BONDAD, unpubl., 1971). Both treated and control fruits failed to develop the yellow color normally associated with the ripening of this variety. However, the treated fruits had a softer texture than the control. Carbon dioxide is known to affect the ripening of fruits and accumulation of this gas inside the bags might have interferred with the ripening processes. About the same results were obtained when fruits were dipped for two minutes in 1000 ppm ACP 70-334 (a stimulant of lycopene synthesis; COGGINS *et al.*, 1970) alone or in combination with 1000 ppm CEPA. With 'Piko' yellowing was observed in fruits dipped for five minutes in 2500 ppm CEPA but the difference from the control was not very marked.

Tomato. — It is assumed without experimental evidence that calcium carbide will degreen (ripen) tomato fruits (ANON., 1971). Other workers (BONDAD and MENDOZA, 1971a; 1971b, BONDAD and PANTASTICO, 1971) have shown however that calcium carbide is not an effective ripening stimulant for tomatoes. Thus the commercial practice of ripening tomato fruits with calcium carbide has no scientific basis. The work on CEPA was prompted by farmers' complain of heavy losses after treatment with calcium carbide.

Similar to bananas, CEPA accelerated the ripening of immature (harvested 21 days after fruit set) and mature-green (28 days) '2029' tomato fruits (BONDAD, et al., 1971; BONDAD, 1971 b). Immature fruits harvested 14 days after fruit set did not ripen after dipping in 10,000 ppm CEPA. The ripening period of mature-green fruits decreased with increasing concentration of CEPA with best concentrations ranging from 2500 to 10,000 ppm and dipping time of five

minutes. With 'Improved Harbot', dipping mature-green fruits for five minutes in 2000 ppm CEPA shortened the ripening period by about six days (BONDAD, 1970a). The total soluble solids and titratable acidity compared favorably with those ripened on the plant. The bacterial wilt resistant line, VC-11-1, also responded favorably to CEPA treatment, ripening within four to five days after dipping or spraying with 5000 ppm solution. A summary of the observations on postharvest ripening is given in table 4.

MODIFICATION OF SEX EXPRESSION IN CUCURBITS

Monoecious cucumbers have a flowering habit of slowly shifting from maleness to femaleness as the vine lengthens. This is a disadvantage to the grower because of the low and delayed fruit production and prolonged growing season. Any treatment that will modify the sex expression of cucumber offers a great advantage since only female flowers can ultimately produce fruits.

Application of 25 to 150 ppm CEPA at the 2nd true leaf stage of a monoecious cv. of cucumber decreased the number of male flowers and increased the number of female flowers and male to female ratio (table 5). About the same effects were observed in "Gulf-stream" muskmelon using 250 ppm (Villegas and Baliñgasa, personal communication, 1971). Apart from modifying the sex expression of *Luffa acutangula* Roxbg. (*Patola*) towards more femaleness (table 6), 250 to 1000 mg/1 CEPA also inhibited extension growth, stimulated profuse branching and induced changes in leaf size and shape.

SUMMARY

A survey of the published and unpublished works on CEPA was made. Off season flowering of mango ('Carabao') and pineapple ('Smooth Cayeene'); concentrating maturity and ripening of tomato ('2029') and coffee (Excelsa and Liberica); acceleration of ripening and degreening of banana ('Lakatan', 'Latundan', 'Leines', 'Saba'), citrus ('Ladu', 'Szinkom', 'Valencia'); and tomato ('Improved Harbot', '2029', 'VC-11-1'); and modification of sex expression of cucumber (native variety), muskmelon ('Gulfstream') and *Patola* (*Luffa acutangula* Roxbg.) were the observed effects of CEPA on some horticultural crops grown in the Philippines.

ACKNOWLEDGMENT

Acknowledgement are extended to Mr. F. C. Manuel and Dr. C. T. Villegas for making available to the author some of their unpublished data and the Marque Chemical Corp. (Philippines) and Amchem Prod., Inc. (U.S.A.) for generously providing the CEPA samples used in the author's own experiments. The author is also indebted to Dr. R. C. Barba for helpful comments and suggestions.

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Table 1. Number of trees flowering following ethephone treatments. Each treatment was replicated on three experimental trees.

Treatment Timing	Concentration (ppm)	28 December 1970	29 January 1971
Twice weekly	75	0	1
	125	2	3
	250	0	0
Weekly	75	0	2
	125	1	1
	250	2	2
Twice monthly	75	1	3
	125	2	2
	250	2	1
Control	—	0	1

From VALMAYOR *et al.* (1971)

Table 2. Relationship between maturity and flowering of 'Smooth Cayeene' pineapple[a] treated with 50 ml 1000 ppm CEPA.

Date Treated	Maturity (Month)	Days to flower	Percent flowering
19 September 1971	1	—	—
17 October 1971	2	—	—
14 November 1971	3	69	20
19 December 1971	4	60.3	30
22 January 1972	5	47.0	100
13 February 1972	6	47.0	100

[a] Planted, 15 August 1971
From Bondad (Unpubl.)

Table 3. Quality of 'Szinkom' citrus fruits four days after treatment with 1000 ppm CEPA for two minutes and 0.3 gm calcium carbide /1 for 24 hours.

Aspect of Quality	Control	CEPA	Calcium Carbide
Color	green	yellow-orange	yellow-green
Firmness (gm)	485.0	385.0**	408.6**
Total soluble solids (%)	5.80	5.85	5.80
Refractive index	1.3460	1.3465	1.3460
Titratable acidity (ml. 0.1N NaOH)	19.3	21.0	23.1
Citric acid (%)	1.23	1.34	1.48
Solid/acid ratio	4.71	4.36	3.24

**Significant at 0.01
From Bondad (1971a)

Table 4. Postharvest ripening of fruits with CEPA

Fruit	Concentration of CEPA (ppm)	Dipping Time (min)	Initial color change (days)	Full coloration (days)	Remarks	Reference
Banana						
'Lakatan' 'Latundan' 'Leines' 'Saba'	2500	5	1 to 2	3 to 5	2500 and 5000 ppm had similar effects on color developments of 'Latundan' and 'Lakatan'; even immature 'Lakatan' ripened with normal color and taste; "fingers" and "hands" had the same response	BONDAD (1971a) BONDAD et al. (1970) BONDAD et al. (1972) TAGUIAMON (1971)
'Latundan'	2500	sprayed	—	2	fruits sprayed to run-off; sweetest fruits obtained at this concentration fruits sprayed and wrapped in polyethylene bags ripened 2.5 days later than those unwrapped	BONDAD, et al. (1972)
Citrus						
'Szinkom'	1000	2	3	4	higher concentration and longer dipping times tended to delay degreening[a]	BONDAD (1971a) BONDAD and MENDOZA (1972)
'Ladu'	2500	5	—	5 to 6	yellow-orange color formed at 70°F	
'Valencia'	2500	5	—	7 to 13	fruits shrivelled due to excessive transpiration; better appearance obtained by wrapping in polyethylene bags	

[a]Citrus fruits are not ripened by CEPA, ethylene, or other ripening agents. Degreening is the term applied to the removal of the green coloring matter (chlorophyll) on citrus peel.

Continuation of Table 4 . . .

Fruit	Concentration of CEPA (ppm)	Dipping Time (min)	Initial color change (days)	Full coloration (days)	Remarks	Reference
Coffee Excelsa	2500	5	2	7	ripening was about the same at 76 or 86°F; least decay observed at 2500 and 5000 ppm	SIERRA and BONDAD (unpubl. 1971)
Papaya	2500	5	—	—	no effect on external color; slight yellowing of flesh observed	BONDAD (unpubl. 1969)
Tomato '2029'	2500	5	2	4	the higher the concentration the shorter the ripening period; immature fruits can also be ripened	BONDAD (1971b) BONDAD *et al.* (1971) TAGUIAMON (1971)
'Improved Harbot'	2000	5	2	6	about the same titratable acidity and total soluble solids as vineripened fruits	BONDAD (1970a) BONDAD (1970b)

Modified from BONDAD (1972)

Table 5. Effect of CEPA on cucumber flowering[a]

TREATMENT (ppm CEPA)	NUMBER OF					Total flowers per plant	Male/female ratio
	Days to anthesis of first flower	Nodes to first flower	Males to first female flower	Male flowers per plant	Female flowers per plant		
0	24.0	4.7	9.7	33.3	2.3	35.7	14.3
25	23.8	4.2	4.0	20.5	2.8	23.0	7.2
50	21.0	3.7	0.8	12.8	4.3	17.2	3.0
75	23.7	5.3	1.0	8.2	4.5	12.7	1.8
100	25.3	5.7	0.8	9.2	4.8	14.0	1.9
125	22.7	5.0	1.0	8.0	5.2	13.2	1.6
150	27.3	5.3	1.0	6.5	6.7	13.2	1.0

[a]Means of three replications
From YABES and BONDAD (1972).

Table 6. The total, female and ratio of male to female flowers produced on the main stem of *Patola* as influenced by varying concentrations of CEPA

mg CEPA/l	Number of flowers on main stem[a]		Male/Female ratio
	Total	Female	
0	19.75	3.25	6.07
250	18.00	5.00	3.60
500	18.25	6.25	2.92
1000	18.25	7.25	2.51

[a]Based on solitary flowers only
From MANUEL (1971)

SOIL AND WATER CONSERVATION THROUGH THE IMPROVEMENT OF SOIL COVER[1]

by

PEDRO N. LAUDENCIA[2]

ABSTRACT

Surface water resources such as rivers, streams, and lakes which abound in the Philippines are slowly being clogged with sediments and soil deposits or are heavily polluted to the extent that only a few of the not-so-delicate species of fish remains. Places which used to be the haven for recreation become murky and quicksandy. Water turbidity caused by suspended fine particles carried by runoff water diminishes the population of phytoplankton which serve as food for fish. Suspended fine particles also suffocate fish by clogging their gills. Rivers and streams which used to be the source of potable water in the rural area are slowly becoming useless for such purpose.

One activity being given impetus by the Philippine government which may help alleviate the worsening condition of surface water resources is the improvement of the soil cover designed to minimize water erosion, sedimentation and pollution. This is being accomplished through (1) improvement of agricultural practices in the field of soil and water conservation; (2) engineering measures, and (3) forest protection and reforestation. This paper discusses present practices and researches being undertaken to achieve this objective. Researches on planting of cover crops, pasture improvement and selection of fast-growing reforestation tree species which are also utilizable for pulp and paper manufacture are described.

INTRODUCTION

Water is a principal resource of the Philippines which affects considerably the national development. It is the source of both good and evil. Properly controlled and managed, it furnishes power, irrigation, domestic water supply, and recreation. Uncontrolled, it can destroy agricultural lands through soil erosion, kill living things and destroy roads, bridges and other infrastructures through floods, impregnate reservoirs, lakes, rivers and recreation areas with sediment, etc.

Water comprises the major portion of the Philippine Archipelago. Composed of 7,100 islands, the Philippines has one of the longest coastlines in the world consisting of 17,460 kilometers or about as long as

[1] Presented during the Workshop on "Water Resources, Environment and National Development" held in Singapore from March 13th-20th, 1972.

[2] Supervising Scientist and Chief, Division of Agriculture & Natural Resources Research, National Science Development Board, Republic of the Philippines.

that of the United States. Its territorial waters with an aggregate spatial coverage of about 167,930,000 is more than six times its land area. It has 85 lakes with an aggregate total of about 199,400 hectares and 1,100 rivers and creeks.

The Climate of the Philippines. — Since temperature variations in the archipelago are really very slight and since rainfall differences are on the contrary important and decidedly variant due to the combined influence of topography and air stream direction, the classification of Philippine climate is based upon the types of rainfall (Figure 1.). In other words, the four types of climate were classified based upon the presence or absence of a dry season and of a maximum rain period, to wit:

FIRST TYPE: Two pronounced seasons; one dry, from November to April, the other wet, during the rest of the year. All the regions on the western part of the islands of Luzon, Mindoro, Negros and Palawan are of this type. The controlling factor is topography. The localities of this type are shielded from the northers and even in good part from the trade winds by decided mountain ranges, but are open only to the Southwest Monsoon and cyclonic storms.

SECOND TYPE: No dry season; with a very pronounced maximum rain period from November to January. In this class fall Catanduanes, Sorsogon, the eastern part of Albay, the eastern and northern parts of Camarines Norte and Camarines Sur, a great portion of the eastern part of Quezon, Samar, the eastern part of Leyte, and a large portion of eastern Mindanao. These regions are along or very near the eastern coast and sheltered neither from the northers and trade winds nor from cyclonic storms.

THIRD TYPE: Seasons not very pronounced; relatively dry from November to April and wet during the rest of the year. The maximum rain periods are not very pronounced, with the short dry season lasting only from one to three months. Regions with this type of climate are the western part of Cagayan (Luzon), Isabela, Nueva Vizcaya, the eastern portion of the Mountain Province, southern Quezon, Masbate, Romblon, northeast Panay, eastern Negros, central and southern Cebu, part of northern Mindanao, and most of eastern Palawan. These localities are only partly sheltered from the northers and trade winds and open to the Southwest Monsoon or at least to frequent cyclonic storms.

FOURTH TYPE: Rainfall more or less evenly distributed throughout the year. The regions affected by this type are the Batanes Province, northeastern Luzon, the Southwestern part of Camarines Sur and Albay, Bondoc Peninsula, eastern Mindoro, Marinduque, western Leyte, northern Cebu, Bohol and most of central, eastern and southern Mindanao.

Mountain climates might reasonably form another type of climate. However, they can be reduced to some of the above types as far as some climatological elements are concerned, except as to temperature which decreases with a gain in altitude and rainfall, which generally increases with height.

The average annual rainfall of the entire archipelago is 99.61 inches and the average number of rainy days is 176. Table 1.

THE PROBLEM

As far back as in the late 30's and early 40's, the Philippines abounds with rivers and streams with crystal clear running waters which teems with fish and other forms of aquatic wildlife. People in the rural areas get their drinking water direct from the streams which also supply in abundance their protein needs in the form of fish in their meals. The lakes were likewise full of edible fishes. Flocks of wildlife such as ducks and other water-loving birds are attractive sceneries in lakes and mouths of rivers. The guerrilla soldiers during World War II were able to resist the Japanese invaders for more than three years because in their hiding places they could easily scrounge for food from wildlife sources such as fish from rivers, streams, and creeks.

Presently, except for a few isolated areas, all these benefits from nature are things of the past. Most of the creeks, streams and rivers are either clogged with sediments and soil deposits or are now heavily polluted to the extent that only a few of the not-so-delicate species of fish remains. Famous fish species which abound in certain lakes like the *banak* or mullet (*Mugil sp.*) of Lake Naujan in the island of Mindoro and the *palos* or eel (*Anguilla* sp.) of Laguna Lake in the island of Luzon are now becoming scarce due to pollution.

Water turbidity caused by suspended particles carried by runoff water to streams, rivers, and lakes diminishes the population of phytoplankton which serve as food for fish. Suspended fine sand or clay particles also directly cause suffocation to fish because their gills could be clogged. Places which used to be the haven for recreation become murky and quicksandy.

People who used to get their water supply direct from rivers and streams now resort to digging shallow and deep wells. But even these sources are beginning to show tell-tales of pollution in some places and signs of extinction in other areas due to poor recharge of aquifers and competition on the part of users.

With a population increase of about 3.2 percent annually, which is one of the highest in the World, the aforementioned problems are bound to be aggravated if remedies are not instituted. The present population is about 38 million.

MEASURES CURRENTLY UNDERTAKEN

To minimize the worsening of the problem mentioned above, the Philippine Government has adopted long-range programs which may be grouped as follows:

Improvement of agricultural practices. — Seven government agencies are directly and indirectly involved in programs designed to minimize water erosion, sedimentation, and pollution thru improved agricultural practices. These are the following:

(1) Agricultural Productivity Commission;
(2) Bureau of Animal Industry;
(3) Bureau of Forestry;
(4) Bureau of Plant Industry;
(5) Bureau of Soils;
(6) National Irrigation Administration; and
(7) Philippine Fisheries Commission.

Through education, actual demonstration, and other known extension methods these government agencies aim to improve the soil cover to conserve soil and water, prevent sedimentation, and control pollution. Practices such as cover cropping, strip cropping, ploughing along contours, deep plowing, farm terracing, pasture improvement, water impounding, etc. are introduced. Application of proper kinds and amount of manures and fertilizers are also given impetus not only to supply vital plant nutrients but to improve cohesiveness of soil particles and strengthen them to be less susceptible to erosion.

Engineering measures. — The Bureau of Public Works sets standards for gutters and drainage channels in land development projects to maximize collection of surface runoff. The use of engineering principles in terrace designs is one of the functions of the Bureau of Soils. The National Water and Air Pollution Control Commission assists factories in designing devices to prevent their wastes from polluting the natural waterways.

Forest protection and reforestation. — Whenever floods occur, a phenomena which is becoming more frequent in the Philippines, the loggers always get the blame. Clogged rivers and streams, quicksandy beaches, and lakeshores are also attributed to them. The real culprit, however, in the denudation of forests in the Philippines is the *kainginero*. A *kainginero* is one who practices shifting agriculture. He follows the loggers through the logging roads and cut all the trees left by the loggers and then burn it to evolve *kaingin* plot. The *kainginero* plant this plot with one crop of upland rice or other crops and after harvesting, he moves on to other areas and do the same leaving behind him a desolate and bare land. When the annual torrential rains come, the top soil is washed away and eventually deposited in streams, rivers, lakes, etc

The *kainginero* is a worse enemy of the forest than forest fires. The Bureau of Forestry takes charge of protecting the forests from unscrupulous loggers, from forest fires and from the *kaingineros.* It is claimed that the hardest to control is the *kainginero* because, being a voter, he easily finds protection from a local politician.

The Reforestation Administration is the government entity that is charged with the function of reforesting the denuded areas that are classified to be non-agricultural.

IMPROVEMENT OF SOIL COVER

The progress of the Philippines hinges a great deal on its water resources. With a national average annual rainfall of 99.61 inches over a surface area of 29,741,290 hectares, it seems that the water balance is favorable. On the other hand, such a tremendous volume of water could do a lot of damage considering that the rainfall could go as high as 34.64 inches in one day. (Table 1.) In fact, the country now suffers heavy damage from floods annually during the rainy months but lack of water is experienced in many areas during the dry months. Heavy deposition of sediment in natural streams raises the stream beds, thus causing higher water stages and more frequent flooding of unprotected land. The expected life and efficiency of dams, reservoirs, navigable rivers, irrigation and drainage canals are diminished due to sedimentaton.

Barring the climatic and geologic factors which are hard to control, men can influence the soil cover which plays a great deal in water conservation and prevention of sedimentation. With respect to vegetation, one can easily discern that water erosion is promoted under the following conditions:

(1) overcutting natural forest;
(2) overgrazing grassland by livestock;
(3) planting crops unsuited to the terrain; and
(4) leaving the soil bare as in *kaingin* agriculture.

The beneficial effect of vegetation in preventing erosion can be analyzed as follows:

(1) The vegetal cover protects the soil surface from the impact of raindrops which otherwise would enhance closing of soil pores;

(2) The roots provide binding effect on the soil;

(3) Vegetation retards the overland flow, thus reducing its transporting capacity; and

(4) Vegetation increases the infiltration capacity of the soil, thus reducing the overland flow and conserves water in the root zones and underneath.

In addition, vegetation uses broken-down organic substances which when allowed to deteriorate under anaerobic conditions in rivers and lakes would constitute bad smelling pollutants.

It was reported in 1961[3] that the total soil cover of the Philippines consists of the following:

	Area in hectares	*Percent*
Commercial forest	9,329,280	31.37
Non-commercial forest	3,842,120	12.92
Swamps and marshes	716,260	2.41
Brushland	2,077,230	6.98
Open land vegetation	3,402,860	11.44
Cultivated crops & others	10,373,540	34.88
T O T A L	29,741,290	100.00

By this time, the commercial forest must have been greatly diminished since it is estimated that 172,000 hectares of forest annually is being destroyed or denuded. Likewise, some of the non-commercial forest, the brushland and open land vegetation areas have been turned into pasture lands. About 3,000,000 hectares of the area devoted to cultivated crops are now planted with rice and only 10 percent of these are irrigated. The irrigated rice lands are generally in the lowlands and are well-protected from erosion by means of levees. It could be gleaned from the above data, therefore, that the major part of the Philippine land area is exposed to the danger of water erosion particularly during the torrential rains common to all places in the Archipelago.

RESEARCHES ON THE IMPROVEMENT OF SOIL COVER

Knowing the problem as mentioned above, several researches have been undertaken in the Philippines aimed at solving such problems. We

[3] Mamisao, Jesus P. 1961. Soil Conservation Trends in the Philippines. *Proceedings of the Interdisciplinary Symposia of the 1961 National Science and Technology Week.*

would like to mention here some results of studies directed toward the improvement of soil cover to minimize floods and sedimentation and to conserve soil and water.

Planting of cover crops. — It is advisable that critical areas are covered with a thick canopy of vegetation, preferably grasses and legumes which are suitable for planting on such critical areas: (1) Guinea grass, (2) tropical kudzu, (3) Bermuda grass, (4) Para grass and (5) Centrosema. In plantations such as coconut and citrus where raising of animals is not intended, the growing of *Calopogonium* as cover crop is recommended.

Pasture improvement. — The Bureau of Forestry, which is the government agency charged with the administration of our range and pasture lands, established a Pilot Range Project with the cooperation of the United Nations Development Program (UNDP), at the Valbueco Ranch, located at Carranglan, Nueva Ecija, in the island of Luzon. The objective is to conduct forage and pasture research and to demonstrate to ranchers how to scientifically increase beef production from the range lands to its optimum level consistent with the principles of conservation of soil and water. The areas was formerly covered with the grass *Themeda triandra,* Porsk. (local name is Samsamong). The area is moderately hilly. Here exotic grass species *viz.*: Alabang X (*Dichantium aristatum* C.E. Hubbardb), coastal Bermuda grass (*Cynadon dactylon* Pers.) guinea grass (*Panicum maximum* Jacq.), Misamis grass (*Cappillipedium assimile* A. Camus), and napier grass (*Pennisetum pupureum* Schumach) were introduced. It was found that soil fertility is a greater limiting factor than soil moisture. Fertilized plots produced more foliage and subsequently increased rainfall interception and minimized surface runoff and erosion. Fertilized coastal Bermuda grass was observed to be a good soil stabilizer.

Researches undertaken by the Bureau of Animal Industry pointed out the advantages of combining grasses with legumes, such as Guinea grass — Centrosema and Para grass — Kudzu combinations, for the improvement of pastures. Legume-grass culture facilitated increase infiltration and protection from erosion.

In the 1960's pasture improvement work was intensified. An area of 600 hectares was set aside in 1963 at the NAWASA (National Waterworks and Sewerage Authority) reservation near the La Mesa Dam, for the establishment of improved pastures by the Bureau of Animal Industry primarily to serve as a seed bank and source of planting materials for distribution to any interested livestock raiser. In the same year, the Dairy Training and Research Institute, a cooperative project between the Bureau of Animal Industry and the U.P. College of Agriculture and assisted by the United Nations Special Fund, began operation, and by 1969, the Forage Husbandry Division of the Institute has worked on about 400 pasture species and cultivars. Among those found very productive were the three common grasses — guinea, napier, para, and the legumes — centro, glycine, and siratro. A recently introduced grass, which is very resistant to drought and is now becoming popular among the graziers is *African* star grass. It is very aggressive and will send out young shoots even during the dry season.

The Bureau of Soils reported that contour planting with the use of ipil-ipil (*Leucaena glauca*) buffers and addition of organic matter to the soil on a 25 percent slope, effectively reduced soil and water losses.

Reforestation. — Reforestation is the biggest single effort being undertaken by the Philippine government to offset the adverse effects of floods, sedimentation and lack of water. While the Reforestation Administration takes charge of actual reforestation projects, other government agencies like the Bureau of Forestry, College of Forestry of the University of the Philippines, the Forest Products Research and Industries Development Commission under the National Science Development Board and the private sector also conduct research to support the reforestation effort of the government. The most significant breakthrough attained in these researches is the selection and identification of fast-growing reforestation tree species which are also utilizable for pulp and paper manufacture. Four such species which are considered exceptional are as follows:

	Common Name	*Scientific Name*	*Ave. Yield*[4] *cu.m/ha./year*
1.	Moluccan-sau	*Albizzia falcata*	43
2.	Kaatoan Bangkal	*Anthocephalus chinensis*	36
3.	Yemane	*Gmelina arborea*	36
4.	Umbrella tree	*Musanga cecropioides*	28

Moluccan-sau, more popularly known as *Albizzia falcata* in the Philippines was introduced from Indonesia in 1938. The ability of this tree to adopt favorably to Philippine conditions has been observed after World War II. It produces viable seeds at 2-1/2 years old. Survival of potted seedlings is high. In 2 years the mean diameter was 14 × 2.03 cm. and the mean height was 10.63 meters.

Kaatoan bangkal is indigenous to India, Burma, Vietnam, Indonesia, Malaysia, Sarawak, Brunei, and Sabah. The Forest Products Research and Industries Development Commission (FORPRIDECOM) of the NSDB has made an intensive study on this species embracing seeding habits, seed extraction, germination, vegetative growth rate and size attained, structure of the wood, mechanical properties of wood, durability, treatability and seasoning. It was reported that the average diameter increment is 2.76 cm. to 2.81 cm. with corresponding average annual height increment of about 1.73 meters. It has also an excellent wood quality. It has been dubbed the "miracle tree" because aside from being a fast grower, it is also suitable for a variety of uses.

Yemane is indigenous to India, Pakistan, Northern Rhodesia and Malaysia. It thrives well in sites with elevations up to 1,750 ft. above sea level. It has a straight bole and attains heights of up to 20 meters. The tree is deciduous and the timber is similar to teak because they belong to the same family. Survival of the potted seedlings was 97 percent. The average diameter of 3-year old trees was 31 cm.

The Umbrella tree is indigenous to West Africa. Being a fast grower at an early age, it initially forms the upper layer of the forest. It matures in 10-20 years. Its rate of growth varies considerably from

[4] Under Mindanao conditions.

place to place. In Bislig, Surigao del Sur, the trees averaged 5.18 ± 0.46 cm. in diameter in two years.

Other promising fast-growing species of trees for reforestation are the Earpod (*Enterolobium cyclocarpium* Griseb.), Benguet pine (*Pinus insularis* Endl.), Agoho (*Casuarina equisetifolia* Forst.), Mindoro pine (*Pinus merkusii* Jungh.), African tulip (*Spathodea campanulata* Bereav.), Gubas (*Endospermum peltatum* Merr.) and the Fire tree (*Delonix regia* Ref.).

Aware of the ever-increasing rate of demand for pulp due to the stepped-up educational program and industrial development in the Philippines, reforestation is now being eyed not as a government and civic duty alone but also as a major industry and occupation of the people. A big paper company in the Philippines has started an agro-forestry project wherein a farmer is given 10 hectares to reforest and to take care as a full-time occupation. The net income derived from this area out of the trees harvested and bought by the pulp and paper company was comparable, if not better, than the net income normally derived from some common agricultural crops. Recently, some banks in the Philippines signified their intention to extend long-term loans to similar agro-forestry projects.

Other soil conservation practices. — The Bureau of Soils reported accomplishments in soil and water practices, as follows:

I. Land Capability Classification		1,971,240 has.
II. Soil Erosion Control Measures:		
A. Mechanical measures		4,542 has.
1. Contour planting, furrowing, ridging	3,532 has.	
2. Broad-base terracing ...	632	
3. Bench-type terracing ...	378	
B. Vegetative measures		7,077 has.
1. Strip cropping, field stripping	212 has.	
2. Cover cropping	3,082	
3. Contour buffers on steep slopes	568	
4. Planting Pastures	1,135	
5. Planting orchard trees in contour	1,920	
6. Grassed waterways	160	
III. Other soil-water conservation practices		368,583 has.
A. Deep plowing	350,000 has.	
B. Green manuring and crop rotation	5,900	
C. Removal of excess water ...	4,064	
D. Water conservation (farm ponds)	142	
E. Others	8,477	
TOTAL		2,351,442 has.

These developments which give income incentives to people to put back on the denuded lands the necessary soil cover to promote soil and water conservation and prevent floods and sedimentation augur well for the Philippines. It is hoped that in the future some of the benefits of nature now lost may be enjoyed once more by our succeeding generations.

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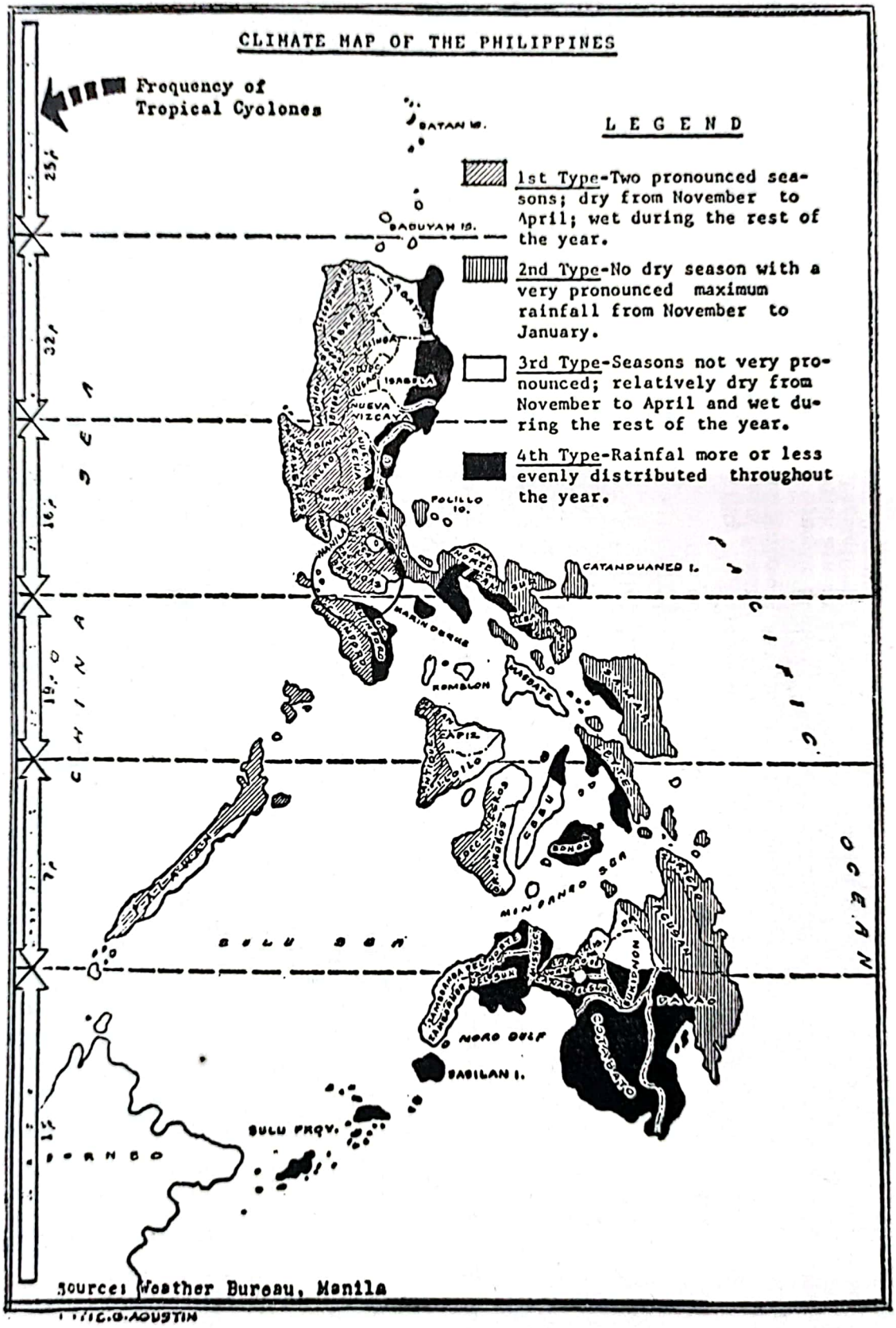


Fig. 1. Classification of Philippine Climate.

REPUBLIC OF THE PHILIPPINES
Department of Commerce and Industry

WEATHER BUREAU
Manila

TABLE I

AVERAGE MONTHLY RAINFALL IN INCHES

Region	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
LUZON	4.95	3.50	3.45	3.58	6.97	9.88	14.42	15.84	13.33	11.52	11.02	8.87	107.34
VISAYAS	7.17	4.58	4.03	3.48	6.26	8.58	9.72	9.16	9.23	10.99	11.03	9.94	94.17
MINDANAO	7.90	5.58	5.81	5.32	7.61	8.25	8.32	7.56	7.80	9.03	8.84	9.70	91.72
PHILIPPINES ..	6.33	4.32	4.18	3.94	6.89	9.10	11.54	11.83	10.77	10.78	10.53	9.40	99.61

AVERAGE RAINY DAYS

Region	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
LUZON	11	8	8	8	13	16	19	19	19	17	15	14	167
VISAYAS	15	11	11	9	13	17	18	17	17	19	17	17	181
MINDANAO	14	11	12	12	15	17	17	16	16	17	17	16	180
PHILIPPINES ..	13	10	10	9	14	17	18	18	18	18	16	15	176

*GREATEST AMOUNT OF RAINFALL EVER RECORDED

Region	Greatest Daily	Greatest Monthly	Greatest Annual
LUZON	34.64 in., July 14, 1911, Baguio City	136.30 in., Aug. 1919, Baguio City	355.84 in., 1911, Bagio City
VISAYAS	22.48 in., Nov. 23, 1928, Borongan, Samar	86.27 in., Jan. 1918, Borongan, Samar	267.32 in., 1934, Borongan, Samar
MINDANAO ..	18.71 in., Dec. 13, Surigao, Surigao	58.27 in., Dec. 1924, Surigao, Surigao	237.73 in., 1934 Surigao, Surigao

Note: Above data were based on the reports of Synoptic Stations operating at present (1960) and do not include the records of cooperative stations and other stations which are already inactive. The years of records range from 6 to 90 years. (*) The amount was collected from 6 a.m. At Baguio City, 45.99 inches was collected from 12 noon to 12 noon (see Weather Bureau Publication-Monthly Bulletin, 1911). Twenty Four (24) hour rainfalls are collected normally from 8 a.m. to 8 a.m.

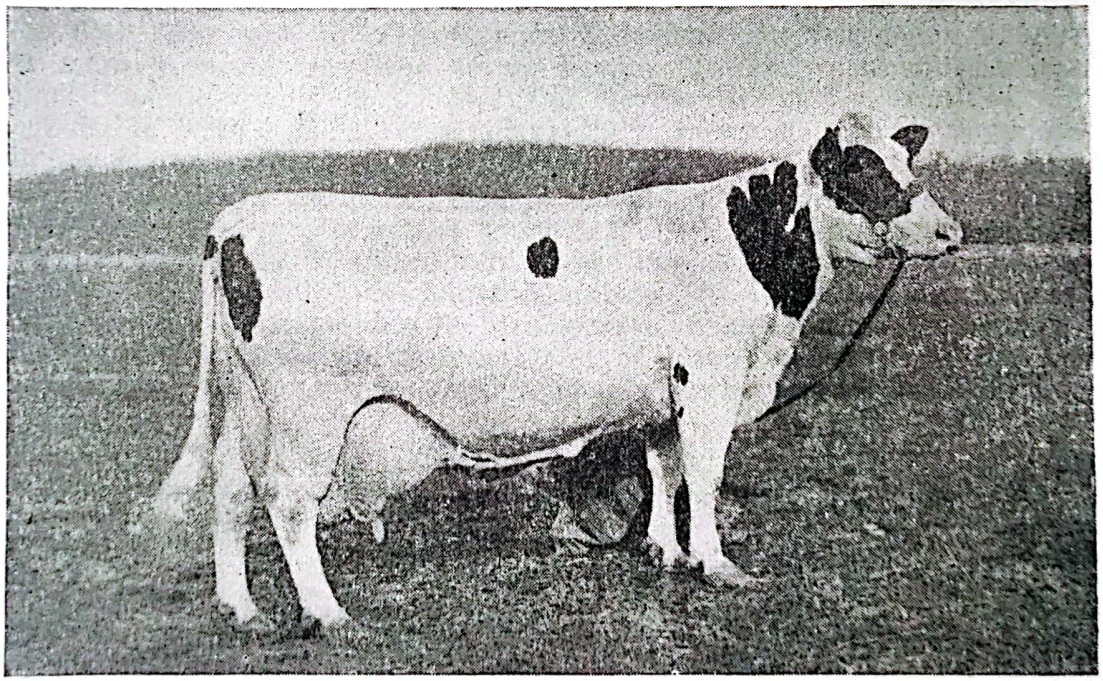
CARNATION ORMSBY BUTTER KING

by

VALENTE VILLEGAS[1]

Carnation Ormsby Butter King, owned by the Carnation Milk Farms, Seattle, Washington, U.S.A., was at one time the champion official and butterfat Holstein cow of the world. She produced 16,995.9 liters of milk and 635.7 kgs. of butterfat in 365 days. Calculated on day basis the production was, therefore, 46.6 liters (over two kerosene cans) of milk a day.

Holstein-Friesian cattle are now known also as the Holsteins. The breed is among the largest breeds of cattle. The native home of the breed is in the Netherlands. The color is a mixture of black and white in patches, an animal with more white being preferred. The breed association of Holsteins in America disqualifies from registration animals possessing the following markings: (1) solid black; (2) solid white; (3) black switch; (4) solid black with white on belly only; (5) black



CARNATION ORMSBY BUTTER KING. — Champion official milk and butterfat Holstein-Friesian cow of the world. Records of production: 16,995.9 liters of milk and 635.9 kilograms of butterfat in 365 days. (Courtesy Carnation Milk Farms, Seattle, Washington, U.S.A.)

[1] Profesor Emeritus of Animal Husbandry, U.P. College of Agriculture, Los Baños, Laguna.

on legs, beginning at feet and extending to knees, with white interspersed; (7) gray, or mixed black and white prevailing; (8) patches of colors other than black and white such as red, brown, dun, etc.; (9) red and white. The breed has small horns directed forward, inward and slightly upward. In the bull, the neck is large, muscular and arched at the top. In the cow, the neck is finer. The body is well-developed. The rump is drooping.

The udder is large but is pendant and faulty in front. The popularity of the breed for dairy purposes is due to the excessive amount of milk it produces. In this respect, it excels other breeds. It also has a quiet disposition, therefore, easy to handle. While in the temperate region its adaptability is well-known, in the Philippines the breed suffers much so that in general its productive life is relatively short. In a Singapore dairy where this breed is used on a commercial scale, the cows are replenished every five years.

ON THE OUTER RIM OF ZION: MORMON OCCUPANCE OF BURLINGTON FLAT, WYOMING

by

MARSHALL BOWEN*

Geographers' investigations of nineteenth century Mormon settlement in the American West have characteristically stressed the pervasiveness of tightly-organized, well-planned ventures into carefully-selected valleys where colonists grouped in nuclear agricultural villages. Here settlers established village-based, self-sufficient farms producing orchard fruits, grains, hay, and small herds of cattle and sheep. Their success depended largely on successful application of meager supplies of water skillfully diverted to the fields from small mountain creeks. The typical Mormon farm village was situated in the midst of a carefully tended collection of small fields, more often than not devoid of any open country population.[1]

Occasionally, however, Mormon settlement and early resource use followed a different pattern, such as that which evolved when a diverse collection of Latter-day Saints migrated to Burlington Flat, along the Greybull River in Wyoming's Big Horn Basin (Fig. 1). This paper, focusing on the first quarter-century of Mormon occupance of Burlington Flat, from 1893 to 1918, demonstrates that this settlement differed in many respects from the better known Mormon communities, and challenges the premise that patterns of Mormon irrigation, land use, and population were shaped from substantially the same mold everywhere in the Mountain West.

In the 1890's Mormons living in the upland valleys of northeastern Utah and adjacent sections of Idaho and Wyoming were beset with a number of difficulties. Unusually severe late-summer droughts reduced Ashley Creek, south of the Uinta Mountains, to a mere trickle, stifling irrigation and compounding the problems of Ashley Valley settlers who had already suffered through a series of bitter winters, a plague of grasshoppers, and a scarlet fever epidemic.[2] Farther north, near Bear

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[1] Some of the standard geographic works on this subject are Spencer, J. E., "The Development of Agricultural Villages in Southern Utah," *Agricultural History*, 14 (1940), pp. 181-189; Geddes, J. A., "Modification of the Early Utah Farm Village,' *Yearbook* of the Association of Pacific Coast Geographers, 8 (1942), pp. 15-22; Meinig, D. W., "The Mormon Culture Region: Strategies and Patterns in the Geography of the American West, 1847-1964," *Annals* of the Association of American Geographers, 55 (June, 1965), pp. 191-220; Speth, W. W., "Environment, Culture, and the Mormon in Early Utah," *Yearbook* of the Association of Pacific Coast Geographers, 29 (1967), pp. 53-67; Francaviglia, R. V., "The Mormon Landscape: Definition of an Image in the American West," *Proceedings* of the Association of American Geographers, 2 (1970), pp. 59-61.

[2] *Builders of Uintah: A Centennial History of Uintah County, 1872 to 1947* (Springville, Utah: Daughters of the Utah Pioneers, 1947), pp. 14-15, 142-143, 291, 324, and 344; McIntosh, J. W., *History of Burlington, 1893-1963* (Burlington, Wyo.: Privately Printed, no date), p. 1; interview with Mrs. Blake Partridge, Burlington, Wyoming, August 16, 1971; interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

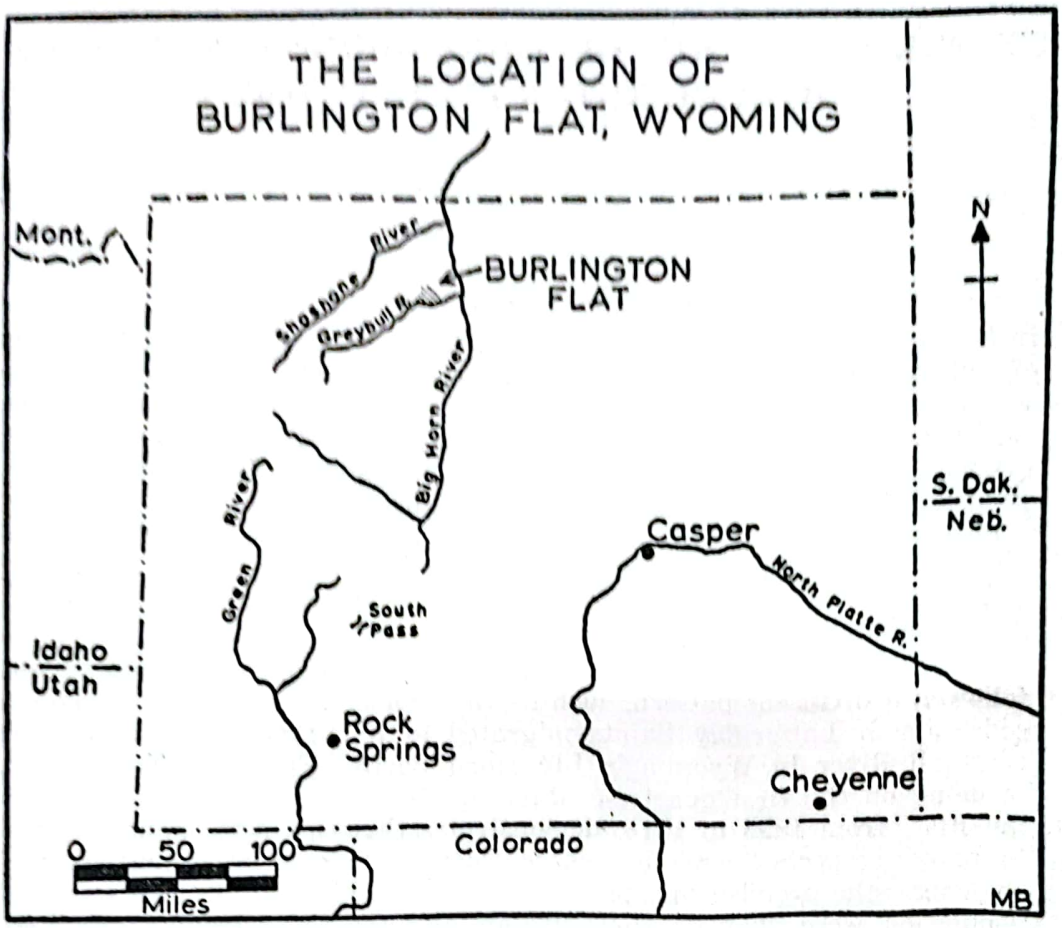

Fig. 1. Latter-day Saints settlement in Burlington Flat Wyoming along the Greybull River (see arrow).

Lake on the Utah-Idaho border, and in western Wyoming's Star Valley, heavy snows and early frosts curbed stockraisers' efforts to produce sufficient feed for their starving cattle.[3] Other men, desiring more acreage to help support growing families, were hemmed in by constricted valleys whose desirable lands had already been taken.[4] These factors accentuated dissatisfaction among a number of disgruntled Saints who had heeded, none too willingly, the Church's call in the 1870's and 1880's to forsake the comforts of the Wasatch oasis for pioneering in the high, remote valleys.[5]

Although Church authorities preferred that these beleaguered settlers remain at home and help strengthen the Mormon grip on valleys already occupied, several families decided that migration to a land of

[3] Interview with Mr. Iva Henderson, Basin, Wyoming, July 29, 1971; interview with Mrs. Meinard Jacobson, Randolph, Utah, August 10, 1971.

[4] Interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971; interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971; Letter to the author from Mrs. Pearl Shaffer, Vernal, Utah, November 28, 1971.

[5] Day, R. B., *They Made Mormon History* (Salt Lake City: Deseret Book Co., 1968), p. 235; *Builders of Uintah...*, *op. cit.*, pp. 12-13, 84-85, 122-128, and 142-143. The Wasatch oasis is a strip of irrigated land between the west slope of the Wasatch Mountains and Great Salt Lake, encompassing Weber, Davis, Salt Lake, and Utah counties.

greater opportunity was imperative.[6] But Mormons had begun to run out of room for expansion. In contrast to the Wasatch oasis settlements, some colonies established by the Church in the 1880's had to be situated in pockets between places already held by Gentile ranchers.[7] Unappropriated land did lie to the northeast, in Wyoming, but for some 175 miles it consisted of the forbidding Red Desert country, the savage Wind River range, and the high, open steppes of South Pass and the Shoshone Basin. For the moment it appeared that men seeking new homes were boxed in by filled-up valleys behind them and a broad belt of wastelands ahead.

Slowly, however, word filtered into the isolated valleys that land suited for agricultural settlement could be found in the Big Horn Basin along the Greybull River, some forty miles south of the Wyoming-Montana boundary. The first information came early in 1892 from a group of Ashley Valley horse thieves who let news of a nearly unoccupied tract of irrigable land along the Greybull River slip out after one of their forays into northern Wyoming.[8] A few weeks later four Mormon travellers arrived home in Ashley Valley after passing through the Big Horn Basin, and corroborated the rustler's report.[9] In autumn, 1892, the son of the Church's President led an unofficial party of scouts into the Big Horn Basin on behalf of a group of Mormons bent on leaving the high, cold Bear River country, and returned to northern Utah impressed by the availability of land and water along the Greybull.[10] Later, a man from Star Valley crossed the mountains and advised his family and friends that winters in the Big Horn Basin were no doubt warmer than in elevated Star Valley, and that Gentile ranchers situated along the river were anxious to hire hands for haying, no matter what their religious calling.[11] On the basis of this rather skimpy collection of information, Mormon families from western Wyoming, southeastern Idaho, and northeastern Utah, risking Church disapproval, prepared to depart for northern Wyoming.

The first Mormon settlers to arrive in the Big Horn Basin were members of a seventeen-family party from Ashley Valley who reached the Greybull River in the spring of 1893 after a difficult wagon train journey through Rock Springs, South Pass, and the Owl Creek Mountains. They were joined by a trickling of families from several high northeastern Utah valleys, a few people from southeastern Idaho, and some men from the country south of Jackson Hole. (Fig. 2) Until they arrived in northern Wyoming, members of these different groups did not know one another, and were only dimly aware that parties other than their own were bound for the Greybull River country. Common interests brought them together, and by the end of the summer approximately fifty families were camped at a place that became known as

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[6] Lindsay, C., *The Big Horn Basin* (Lincoln: University of Nebraska Press, 1932). pp. 163-165.

[7] Meinig, *op. cit.*, pp. 204-208.

[8] Interview with Senator Leland Sowards, Vernal, Utah, August 12, 1971.

[9] McIntosh, *loc. cit.*, interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

[10] Lindsay, *op. cit.*, p. 164.

[11] McIntosh, *op. cit.*, p. 2; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971.

"Mormon Bend," on the north bank of the Greybull River, twenty-five miles from its confluence with the Big Horn River.[12]

Although a few newcomers built crude shacks at Mormon Bend, most colonists weathered the winter of 1893-1894 in tents, for the bulk of them had little intention of staying at their first gathering place. Here there was little more to tempt them than a two mile wide strip of gravelly floodplain covered with low sagebrush, fringed on the river side by a few spindly cottonwoods, and rimmed on the north and south by bare, broken tracts of badlands. But exploration of the immediate neighborhood during the winter revealed that while the floodplain narrowed to the west, it opened on the downstream (eastern) side to a width of four to five miles between the river and a terrace bluff. In this area, most land, sloping gently to the east, lay just five to fifteen feet above the river level, and appeared to lend itself admirably to irrigation. Sagebrush on the broader part of the floodplain grew to

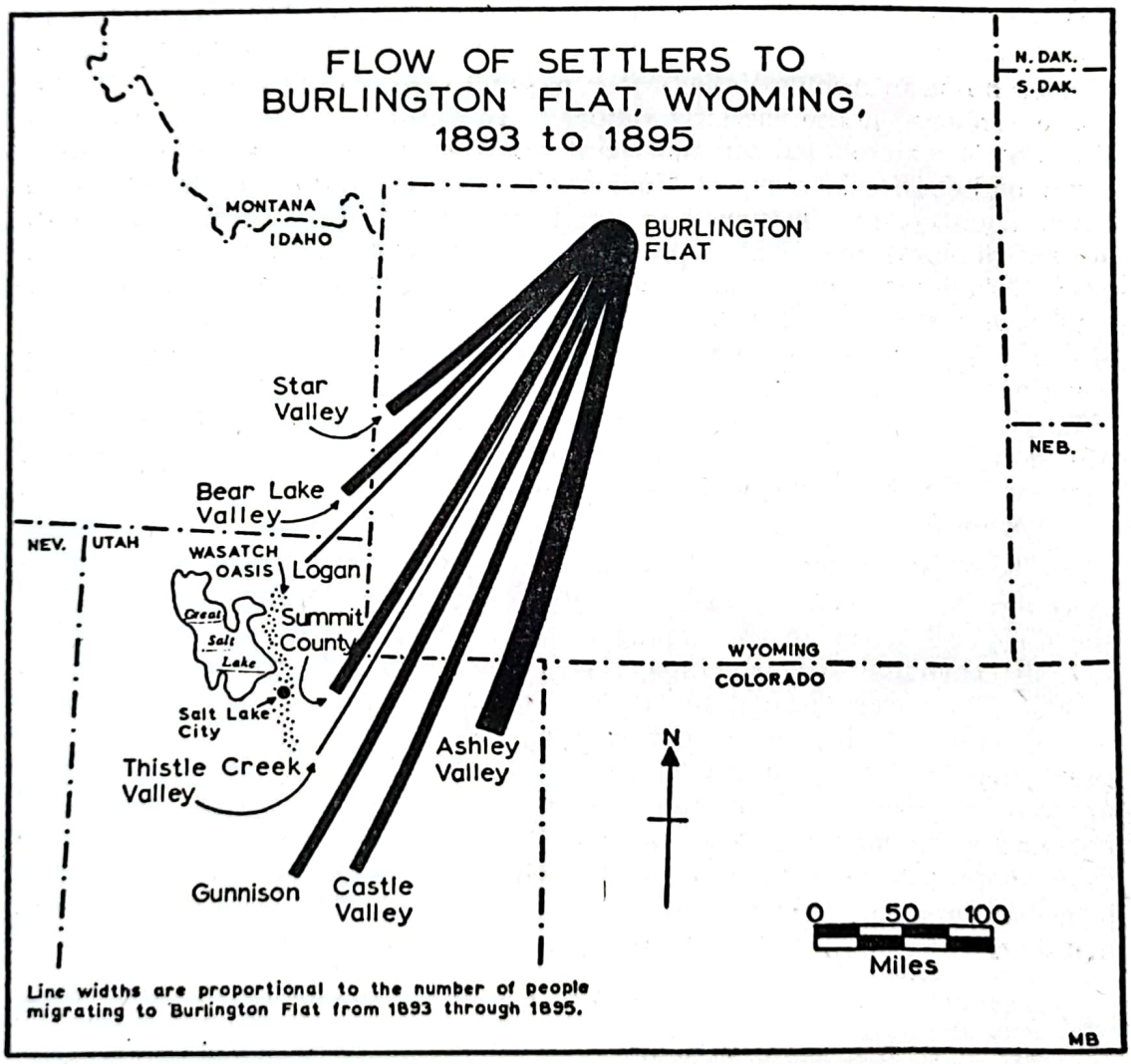

Fig. 2. Flow of Settlers to Burlington Flat, Wyoming.

[12] Welch, C. A., *History of the Big Horn Basin* (Salt Lake City: Deseret News Press, 1940), p. 49; McIntosh, *op. cit.*, pp. 1-2; Lindsay, *loc. cit.*, interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

ten or a dozen feet, a fact which the Mormons interpreted as indicating that this flat possessed better soil and received more rain than most Rocky Mountain basins.[13] In their first assumption they were correct, for much of the sage-covered alluvial land that they criss-crossed contains productive deep loams and fine sandy loams.[14] Their judgment of rainfall, however, was considerably in error. Long-term records indicate that this part of the Greybull Valley receives just a shade more than six inches of precipitation annually, two inches less than the driest part of Ashley Valley, and less than half as much as normally falls on the other mountain valleys from which the settlers had come.[15]

Some settlers argued that a nearly dead-flat terrace (now called Emblem Bench) situated just north of the floodplain might provide even better irrigation opportunities than the flat, and construction of a ditch was actually started there,[16] but inadequate engineering experience and lack of sufficient equipment or capital to purchase machinery quickly stymied Mormon efforts to divert Greybull River water to the bench, which lies roughly fifty feet above the floodplain.[17] Furthermore, some Saints expressed concern about occupying the long, narrow terrace, where settlers would be strung out on a tract some eleven miles long but only two miles wide, and opted for locating on the floodplain, where a compact colony four or five miles square could be readily established.[18] After considerable heated discuss on, complicated because the group had no officially-designated or Church-sponsored leader, the men at Mormon Bend agreed that the combine advantages of flat land with probably fertile soil close to a dependable water supply, plenty of unclaimed acreage in a compact unit, and availability of employment opportunities at riverside ranches made floodplain settlement preferable to living on the terrace.[19]

Settlement on the floodplain, which the Mormons named Burlington Flat in the mistaken belief that the Burlington railroad would build a branch line through their community, was dispersed from the very start. The disorganized pioneers, acting without Church sanction or advice, and lacking an effective spokesman, were unable to obtain permission to secure title to land without living on it. Their situation differed from that of Mormon colonists who came to Wyoming's Shoshone Valley a decade later, after Church officials had obtained a special ruling allowing them to live in villages and legally claim land on which they had no intention of residing.[20] The Burlington colonists simply scattered across the floodplain, claiming random quarter-sections alongside or

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[13] Mary McNiven Partridge, quoted in Welch, *op. cit.*, p. 156; interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971, interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971.

[14] Thorp, J., *et al., Soil Survey of the Basin Area, Wyoming* (Washington: U.S. Dept. of Agriculture, Bureau of Chemistry and Soils, 1928), pp. 14, 17, 35-36.

[15] *Ibid.*, p. 3; Precipitation records on file at the U.S. Dept. of Agriculture Soil Conservation Service Office, Greybull, Wyoming.

[16] Linday, *op. cit.*, p. 165.

[17] McIntosh, *op. cit.*, p. 3; interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

[18] Interview with Mrs. Blake Partridge, Burlington, Wyoming, August 16, 1971.

[19] McIntosh, *loc. cit.*, Lindsay, *op. cit.*, pp. 165-167; Welch, *op. cit.*, p. 50; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971; interview with Mrs. Blake Partridge, Burlington, Wyoming, August 16, 1971.

[20] Lindsay, *op. cit.*, pp. 167 and 204; Welch, *loc. cit.*

within easy reach of the proposed main irrigation canal route. (Fig. 3)[21] This action fostered a population pattern decidedly different from that of most Mormon settlements, which focused on agricultural villages surrounded by largely unpeopled farmland. By December 31, 1895, 8,920 acres, nearly half of Burlington Flat, had been claimed and was occu-

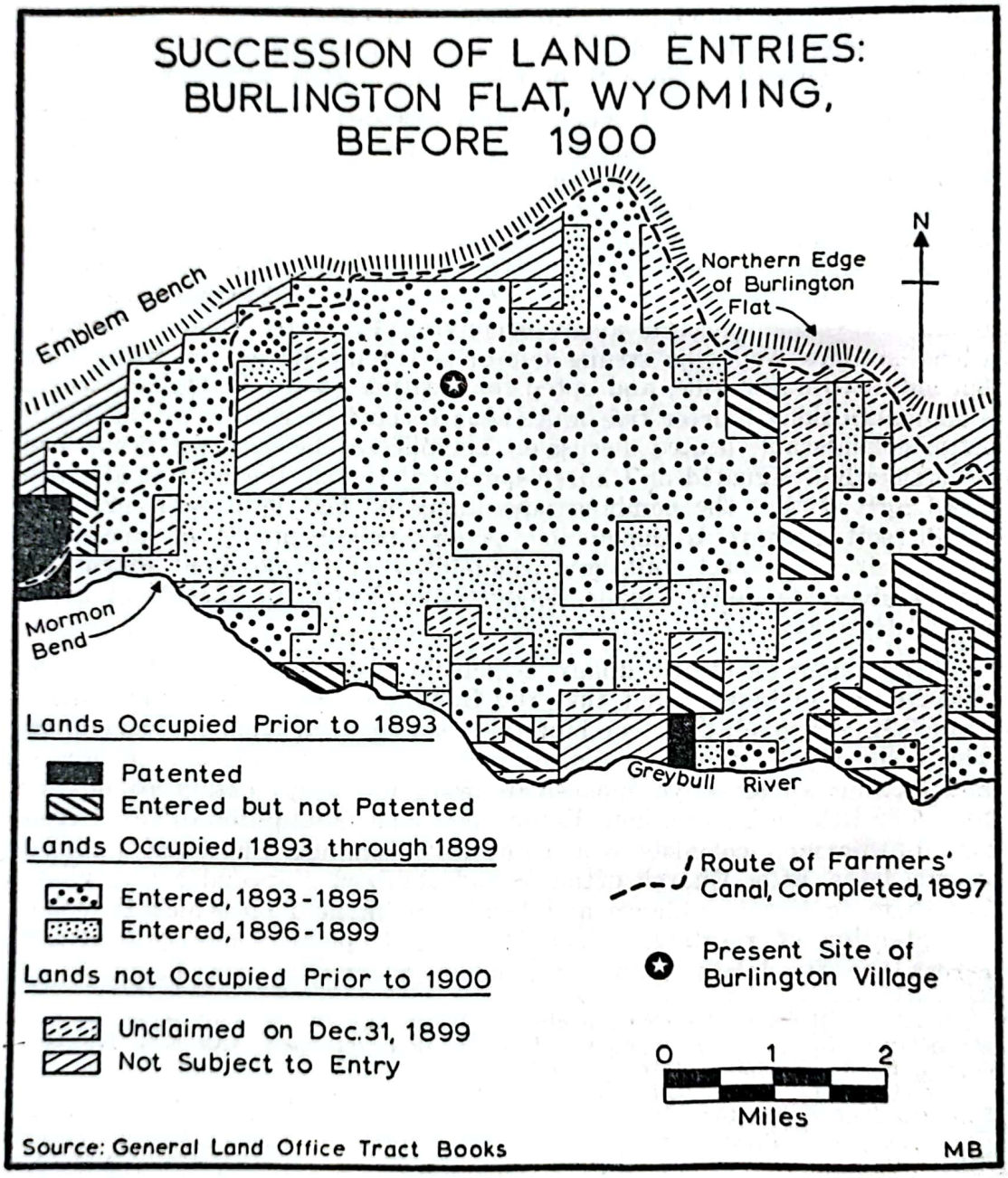

Fig. 3. Map showing Burlington colonists occupying the areas of the flood-plain in a scattered pattern.

[21] McIntosh, *op. cit.*, pp. 3-6; Welch, *loc. cit.*; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971; Andrew Jenson, compilor, "History of Burlington Ward, Wyoming," MS in Church Historian's Office, Salt Lake City, Utah.

pied by Mormons, but plans for a village on the flat had not yet been formulated.[22]

In contrast to Mormons living in the lower, warmer valleys near Great Salt Lake, the men who took land on Burlington Flat were largely livestock raisers, not farmers. Every settler from Ashley Valley, where livestock production held sway over farming, was a cattleman or a sheep

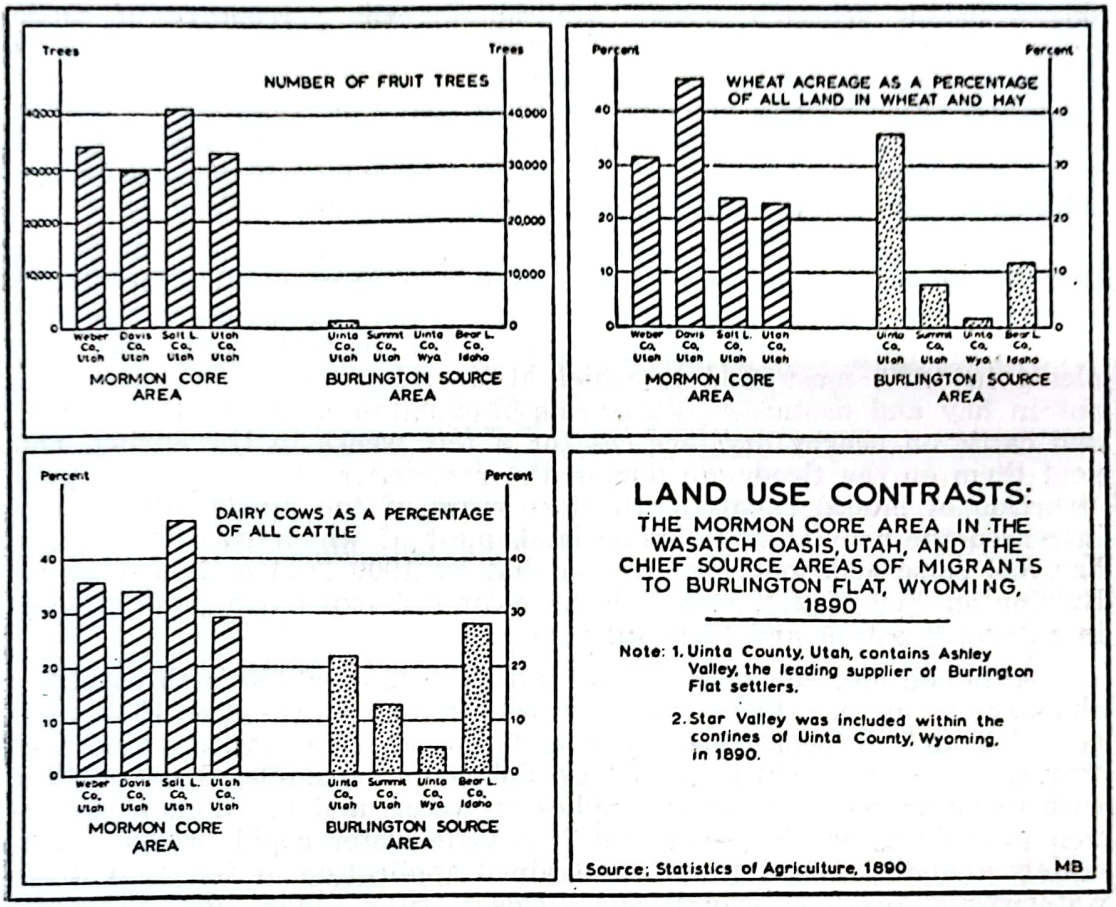

Fig. 4. Graphs showing three key land uses in Burlington Flat.

raiser, except one individual who had broken horses for a living before coming to Burlington.[23] The other Burlington Flat homesteaders had similar backgrounds. For example, most migrants from Star Valley were small, struggling ranchers who ordinarily cut some wild, native hay, but never even bothered with planting alfalfa, while the few men who did produce grain in the Bear Lake country simply fed it to their livestock.[24]

Figure 4 points out three key land use differences that existed in 1890 between the Wasatch oasis — traditional cornerstone of Mormon

[22] General Land Office Tract Books, on file at the Federal Record Center, Suitland, Maryland. Additional lands around the fringes of Burlington Flat, particularly along the Greybull River, had been filed on by non-Mormons before 1893.

[23] *Builders of Uintah . . ., op. cit.*, pp. 87, 128, and 143; interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971; letter to the author from Senator Leland Sowards, Vernal, Utah, September 14, 1971; letter to the author from Mrs. Pearl Shaffer, Vernal, Utah, November 28, 1971.

[24] Interview with Mr. Marion Henderson, Basin, Wyoming, July 29, 1971.

culture — and the upland areas that provided the largest share of Burlington settlers. By that date fruit trees numbered well over 100,000 in the Wasatch oasis, whereas three of the countries supplying Burlington homesteaders could not claim a single bearing fruit tree. Comparison of wheat acreage with land in hay demonstrates another difference: crop raising among the men who settled Burlington was directed toward production of livestock feed, in contrast to a stronger cash crop emphasis in the Wasatch oasis. Additionally, the percentage of cattle classed as milk cows was higher in each Wasatch oasis county than in the most strongly dairy oriented unit of the Burlington source area.[25] Together, these figures support the view that the mountain valleys in and around northeastern Utah were lands of hay fields, pastures, and range rocks, in contrast to the core of Mormondom, where cash grains, milk cows, and orchards played much more prominent roles.

In the light of this resource use background, it is not surprising that the Mormons who settled Burlington Flat showed little inclination to raise crops. They did produce a few garden vegetables in the first years, and even planted some wheat, but when the main canal was completed in 1897, most land to which it provided irrigation water was put in hay and pasture.[26] As a rule Burlington men ran their sheep and cattle on nearby dry terraces for a few weeks in the spring, and kept them on the floodplain during the remainder of the year.[27] Construction of lateral canals in the last years of the nineteenth century increased the amount of irrigable land, most of which was utilized for hay and some additional pasture, so that by 1900 land use patterns on Burlington Flat firmly reflected the colonists' experience and interest in raising livestock and livestock feed.[28]

Although Mormon settlers have usually been credited with considerable irrigation expertise[29], the men who settled Burlington Flat were not adequately informed about the subtleties of irrigating the land that they claimed. Pioneers from Ashley Valley, for example, were familiar with using extremely meager supplies of water, and based their irrigation procedures on the belief that if a little water could produce moderately abundant crops, then unrestrained application of Greybull River water would result in magnificent yields.[30] Star Valley folk, and some of the men from Bear Lake country, had no first-hand experience with irrigation, for the pastures on which they had formerly run their stock were naturally wet riverside meadows producing wild hay.[31] These settlers followed the lead of the most experienced irrigator on the

[25] *Statistics of Agriculture in the United States at the Eleventh Census: 1890* (Washington: Government Printing Office, 1895).

[26] Welch, *loc. cit.;* McIntosh, *loc. cit.;* Jenson, *loc. cit.;* interview with Mr. Marion Henderson, Basin, Wyoming, July 29, 1971.

[27] Interview with Mr. Glenn Johnson, Powell, Wyoming, July 30, 1971; interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

[28] Interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971; interview with Mr. Marion Henderson, Basin, Wyoming, July 29, 1971; interview with Mr. Glenn Johnson, Powell, Wyoming, July 30, 1971.

[29] For example, Speth, *op. cit.,* pp. 60-61; Spencer, *op. cit.,* pp. 183-185; Arrington, L. J., *Great Basin Kingdom: An Economic History of the Latter-day Saints, 1830-1900* (Cambridge: Harvard University Press, 1958), pp. 52-53; Hollon, W. E., *The Great American Desert: Then and Now* (New York: Oxford University Press, 1966), pp. 104-107 and 160-161.

[30] *Builders of Uintah..., op. cit.,* pp. 290-291; interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971.

[31] Interview with Mr. Marion Henderson, Basin, Wyoming, July 29, 1971.

Flat — the Ashley Valley people — and allowed water to flood unchecked across their fields for as long as forty-eight successive hours.[32]

Because no one among the Mormons had bothered to cut drainage ditches across Burlington Flat to carry water back to the river, it took only a few months of excessive irrigation to thoroughly saturate the heavy alluvial soils. Standing water became a familiar sight in virtually every field.[33] When water did finally enter the ground it filtered downvalley and waterlogged land a half-dozen or more miles to the east. As early as 1896 a farmer living near Otto, ten miles southeast of present Burlington village, abandoned his floodplain homestead because the land had become too boggy to farm because of "drainage from the farms higher up." He relocated on higher ground near the northeast edge of Burlington Flat, but six years later this land had also be-

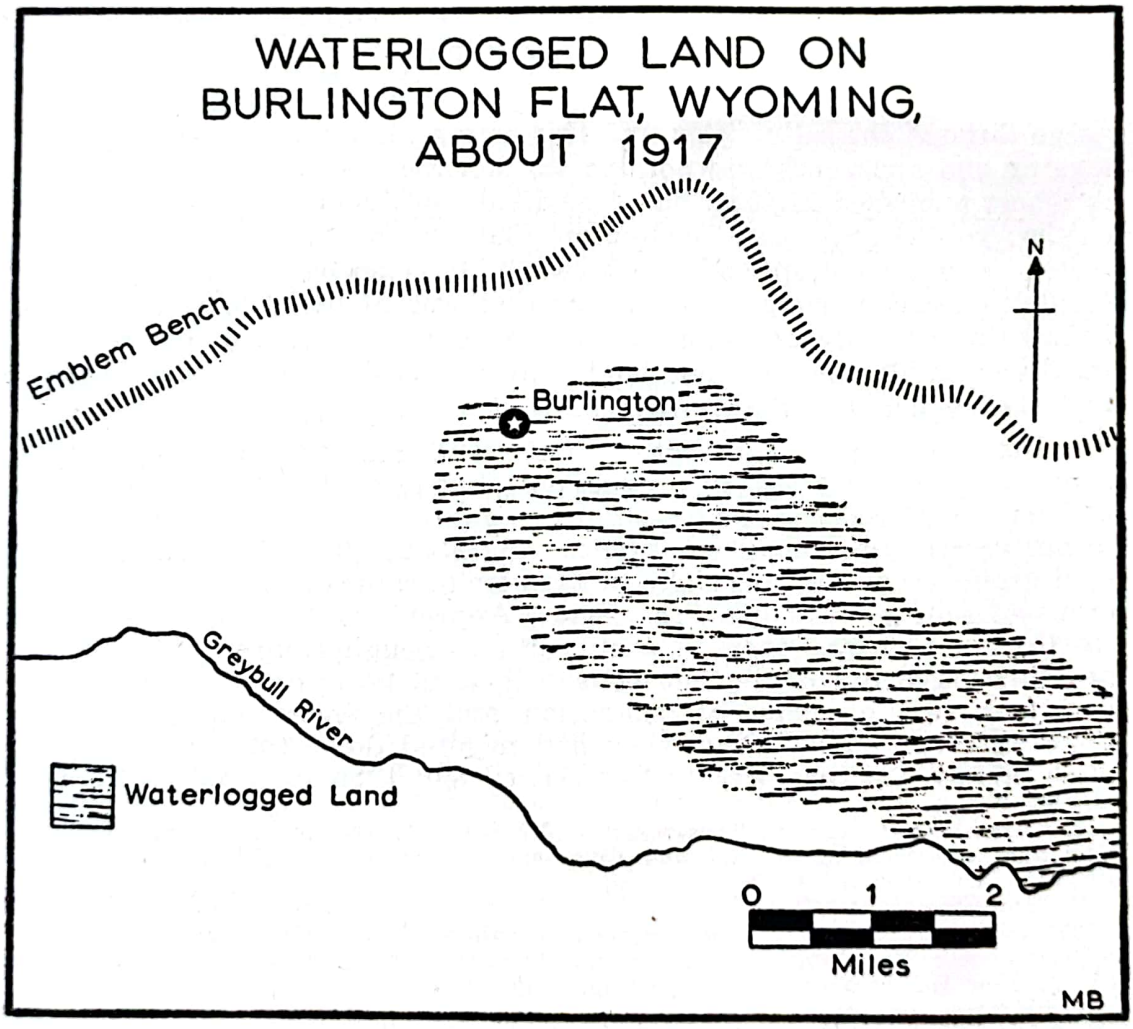

Fig. 5. .Sketch map showing south and east of Burlington underwater.

[32] Interview with Mr. Glenn Johnson, Powell, Wyoming, July 30, 1971; interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971.

[33] Interview with Mr. Oscar Preator, Basin, Wyoming, July 23, 1971; Melva Boyd, untitled manuscript on settlement of the Burlington-Otto area, no date, in possession of Miss Ella Yorgason, Burlington, Wyoming.

come too wet to plow, so he left the Big Horn Basin entirely.[34] By 1903 most of Burlington Flat was waterlogged.[35] Some individuals tried to construct effective drainageways, but since most Mormons persisted in overirrigating, seepage wiped out the benefits that frustrated ditch-diggers hoped to achieve. By 1917 virtually every field on the Flat was still soggy, and frequently the land south and east of Burlington village resembled a shallow lake, with water washing from field to field across the roads, making travel almost impossible.[36] (Fig.5)

Salt encrustations coated Burlington soils when mineralized surface waters evaporated and ground water containing concentrated salts rose to the surface by capillary action and then also evaporated. One man recalled that in 1901

> Vast tracts of land that had been under irrigation for a few years were turning white with alkali. I could not look ahead far enough to know that we would not be able to ever make a good living on this place.[37]

Resident tried to wash out the salts by allowing additional water to surge through the salty fields, but this action merely accentuated water-logging and apparently did nothing to alleviate the alkalinity problem.[38] A report published in 1928, based on field work conducted several years earlier, specifically cited Burlington Flat as an area where alkali-affected areas were "especially numerous." It is probable that from two-thirds to three-quarters of the entire Flat was afflicted to some degree by alkalinity.[39] By the end of the first quarter-century of Mormon residence on Burlington Flat, land quality was decidedly lower than it had been when the Saints first arrived.

Deterioration of Burlington Flat's land resources solidified residents' devotion to livestock production. Boggy and alkali fields which had formerly produced some cash grains and truck crops were converted to pastures and low-quality hayfields. By about 1910 alfalfa and a few feed grains occupying especially favored well-drained spots were the only crops of note anywhere on the Flat. Approximately sixty percent of Burlington Flat was then in pasture.[40] Although Church officials repeatedly urged Burlington Mormons to "put in large crops,"[41] the Flats' residents, heeding personal inclination and the sheer impossibility of growing crops on land that they had misused, kept the bulk of their land in hay and pasture.[42] Presence of small bunches of cattle and

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[34] John Wesley Morrow, "The Story of My Life," typescript of the reminiscences of a man who lived in the Greybull River valley from 1888 to 1902, in possession of Mrs. Lena Perkins, Basin, Wyoming.

[35] Interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971.

[35] Interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971; interview with Mr. Oscar Preator, Basin, Wyoming, July 23, 1971; interview with Mr. Marion Henderson, Basin, Wyoming, July 29, 1971.

[37] Morrow, *op. cit.*

[38] Interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971.

[39] Thorp, *et al.*, *op. cit.*, pp. 17, 35-36, and map drawn to accompany the text.

[40] McIntosh, *op. cit.*, p. 13; interview wtih Mr. Glenn Johnson, Powell, Wyoming, July 30, 1971; interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971.

[41] Burlington Ward Historical Record, April 22, 1917, April 29, 1917, and May 9, 1920. On file in Church Historian's Office, Salt Lake City, Utah.

[42] Interview with Miss Ella Yorgason, Burlington, Wyoming, August 17, 1971; interview with Mr. Everett Riley, Basin, Wyoming, July 23, 1971; interview with Mr. Glenn Johnson, Powell, Wyoming, July 30, 1971.

flocks of sheep slogging through a collection of wet pastures made the Burlington Flat landscape noticeably different from the stereotype of Mormon colonists' irrigated lands elsewhere.

Deviation from patterns normally associated with Mormon settlement also applied to Burlington village. Forced by law into dispersed rather than nucleated residential patterns, the Mormons were slow to found a village on the Flat. They did build a log schoolhouse about halfway between Emblem Bench and the Greybull River in 1894, and used this structure for church meetings, but it never became the focus of a nucleated settlement. Instead, the real beginning of present Burlington village occurred in 1897 when two neighbors, one of whose cabins doubled as a postal station, donated forty acres to the community for establishment of a town. By 1900 a chapel, a meeting house, a store, a hotel, and a few homes had been erected on this site.[43] Additional land was laid off as town lots in 1902, for Church leaders encouraged settlers who had obtained patents to land on the Flat to move into what they hoped would become a Utah-type agricultural village. Although a handful of men did respond by building homes in town, "quite a number still preferred to live on their farms."[44]

Presence of non-Mormons east and west of Burlington Flat and, after 1900, on Emblem Bench, prompted several Gentile entrepreneurs to obtain unoccupied town lots in Burlington for operating drinking establishments. By 1902 at least three saloons were in business in Burlington, and devout Saints were imploring the youth of their community to quit lounging around the saloons, drinking beer and whiskey.[45] But even without Mormon patronage these businesses thrived. A traveller who stayed overnight in Burlington in 1905 commented on the character of his lodging place:

> Of all places where I have slept none excelled this one in points of crude construction and wild surroundings. The first floor was a combined saloon and dining room with a roulette wheel going full blast in one corner. Wandering in and out were a typical array of western characters whose wit and humor deteriorated as evening advanced. By midnight the place was a bedlam.[46]

By 1905 Burlington's village population numbered about fifty, and included just a few Mormon farmers living among the gamblers and saloon keepers. Conveniently located about halfway along the road from Basin to Cody, a distance of fifty-three miles, the little town was ideally situated to serve the needs of rough cattlemen in from the range, travellers crossing from the Shoshone to the Greybull River, and German settlers living on Emblem Bench, as well as the staid Mormons for whose benefit the town was originally established.[47] The fact that as

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[43] Jenson, *loc. cit.*; McIntosh, *op. cit.*, p. 6; Welch, *op. cit.*, p. 50; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971.

[44] McIntosh, *loc. cit.*; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971. Quotation from McIntosh.

[45] Burlington Ward Historical Record, January 26, 1902 and July 6, 1902; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971.

[46] James W. Hook, "Seven Months in Cody, Wyoming, 1905-1906," *Annals of Wyoming*, 26 (January, 1954), p. 9.

[47] *Ibid.*, interview with Mrs.. Iva Henderson, Basin, Wyoming, July 29, 1971.

late as 1916 Church elders still spoke out against saloons and pool halls in their midst, and that a small Baptist church was holding services only two blocks from the Mormon ward chapel, suggests that Burlington village a quarter-century after Mormon arrival on the Flat was something more than a quiet residential center for Latter-day Saint farmers, and something less than the idealized Mormon village[48]

Today, Burlington Flat exhibits most of the traits discernible more than a half-century ago. Most residents are Mormons living scattered across the floodplain. Livestock production still predominates. Nearly sixty percent of the Flat is in pasture, over fifteen percent is in hay, and another eleven percent is in corn destined for livestock consumption. Pastures, hayfields, and cornfields all show unmistakable signs of continued overirrigation and inadequate drainage. Burlington village contains barely one hundred residents, only two of them farmers, and while it does exhibit some visual characteristics of the classic Mormon town, its two business establishment — a general store and a bar — are operated by Gentile intruders, and serve people living beyond Burlington as much as Mormons on the Flat.

Establishment and persistence of Burlington as a Mormon community without the "look" of Mormonism rests primarily upon the circumstances of its settlement. Its colonists were independent, somewhat disorganized Mormon stockraisers from the uplands in and around northeastern Utah, not Latter-day Saint farmers from the Wasatch oasis. Their inability to obtain permission to homestead as a group led the Flats' dispersed population pattern, while settlers' bias toward livestock production guided evolution of its land use system. Inexperience with irrigating heavy soils when an abundance of water was available produced continuing problems of waterlogging and soil alkalinity, which firmed up decisions to use Burlington Flat for pastures and hayfields. Failure to create a nuclear agricultural village at the outsetofsettlement led to eventual establishment of a quite different sort of town. These conditions support the viewpoint that settlement of a Rocky Mountain basin in the 1890's by people who just happened to be Latter-day Saints did not necessarily guarantee that the settlement area would take on carbon-copy characteristics of Mormon colonies elsewhere in the American West.

[48] Burlington Ward Historical Record, March 20, 1916; McIntosh, *op. cit.*, p. 5; interview with Mrs. Iva Henderson, Basin, Wyoming, July 29, 1971.

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Owner: PHIL. GEOGRAPHICAL SOCIETY	Bureau of Soils
Publisher: PHIL. GEOG. SOCIETY	Bureau of Soils
Printer: BOOKMAN PRINTING HOUSE ..	Quezon Blvd. Ext., Quezon City
Office of Publication:	Bureau of Soils

In case of publication other than daily, total number of copies printed and circulated of the last issue dated January-February-March, 1972.

1. Sent to paid subscribers	450
2. Sent to others than paid subscribers	550
T o t a l	1,000

(Sgd.) DOMINADOR Z. ROSELL
Business Manager

SUBSCRIBED AND SWORN to before me this 8th day of April, 1972, at Cavite City, the affiant exhibiting his Residence Certificate No. A-73795, issued at Manila on January 10, 1972.

(Sgd.) OVIDIO S. DE LA ROSA
Notary Public
Until December 31, 1973

What's in a label?

A revered tradition and a whole lot more.

This was the label of our first San Miguel beer bottle in 1890. That's why we're sentimental about it. Our labels don't look like this anymore but the enthusiastic acceptance of our beer opened the way for pioneering in such industries as soft drinks in 1920; dairy products in 1925; glass manufacturing in 1938; poultry and livestock feeds in 1954; and our investments in mining, food products, steel drums, jute bags, ramie fibers and construction materials.

Founded in 1890 with capital of ₱180,000, San Miguel Corporation has become an enterprise employing more than 15,000 people and with total assets of over ₱630 million. We have so expanded and diversified that there is hardly a time when we are not involved with our people's way of life. And all these began with a label.

SINCE 1890

San Miguel Corporation

HOME OF QUALITY PRODUCTS

San Miguel Pale Pilsen (Bottled) • San Miguel Pale Pilsen (Canned) • San Miguel Pale Pilsen (Draught) • San Miguel Cerveza Negra □ Coca-Cola • Royal TruOrange • Royal Lem-O-Lime • Royal Tru-Lemon • Royal Soda • Royal Tonic Water • Royal Ginger Ale □ Glass Containers • Pressed Glassware • Alumina Sand • Corrugated Board Boxes • Aluminum Collapsible Tubes • Tuboplast Polyethylene Containers • Plastics • Applied Color Decorations • Metal Closures • Metal Lithography □ Magnolia Ice Cream • Magnolia Sherbet • Magnolia Ice Cream Cakes • Magnolia Frozen Delights • Magnolia Fresh Cow's Milk • Magnolia Whole Cow's Recon Milk • Magnolia Choco-Lait • Magnolia Slender Milk • Magnolia Buttermilk • Magnolia Yoghourt • Magnolia Sour Cream • Magnolia Slender Cottage Cheese • Magnolia Whipping Cream • Anchor Butter • Choco-Vim • Magnolia Frozen Strawberries • Magnolia Cones • Carnival Frozen Cream □ B-Meg Poultry & Livestock Feeds • Fleischmann's Active Dry Yeast • Fleischmann's Compressed Yeast • CO_2 (Liquid & Solid)