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John F. Bergmann

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## SOIL SALINIZATION AND WELSH SETTLEMENT IN CHUBUT, ARGENTINA

To a people accustomed to the wet, green hills of wellwatered Wales, and unacquainted with deserts except for that they had read in the canonical writings, survival in arid Patagonia proved a challenge almost the equal of even hardy Welshmen. In July, 1865, 153 Welsh settlers landed on the desert shore of Chubut, ill-prepared for the Patagonian winter. However, it was the desire of each settler to attempt a new life in Patagonia, a land at that time not yet won from the native Tehuelche Indians. They had come to establish a new Welsh culture hearth, a « Wales away from Wales », far from the English, where Welsh language and Welsh tradition could be preserved.

These Welshmen were mostly town and village dwellers ; not more than four or five among them were farmers. So ill prepared were the first immigrants for living in an arid land that the entire colony came close to perishing on several occasions during the first years. Repeated material assistance from a sympathetic Argentine government and from supporters in distant Wales along with persuasion and perseverance sustained the destitute and hapless group.

The turning point occurred in November, 1867, when Mrs. Aaron Jenkins, accompanying her husband to chapel one Sunday, discerned the possibility of artificially watering her husband's parched field from the river. It was spring and the Chubut River was running high with melt water from the snows of the distant Andes, higher within its levees than the adjacent fields. On Monday, following the sabbath, Mr. Jenkins cut a breach in the levee, allowing just enough water through to wet his field thoroughly before stopping the flow again. His wheat crop revived, matured, and in a few months was the first successful crop harvested in Chubut.

Seeing the results of Mrs. Jenkin's discovery, the colonists commenced digging a rudimentary system of primary and secondary canals to reach other farms in the valley. The river was tapped in the upper valley so that during the season of high water the canals would be filled. Although there were irregularities in the river's flood stage from year to year, with floods sometimes so high as to wash out canals and cover much of the valley bottom, and at other times failing even to reach the level of the canal intakes, the Welsh farms, nevertheless, spread through the valley, and by 1886 most of the good valley land was covered with a grid of 100 hectare farm plots. All but the poorest lands were by then under cultivation.

The Welsh had found a key to making a living in a dry Patagonian valley, but they were inexperienced in using it. Before the turn of the century crops from some of the farms had begun to decline seriously and the cause was the accumulation of salt in the upper soils. One of the first farms affected was that of Mr. Hughes near Gaiman in the 1890s. Disasterous floods

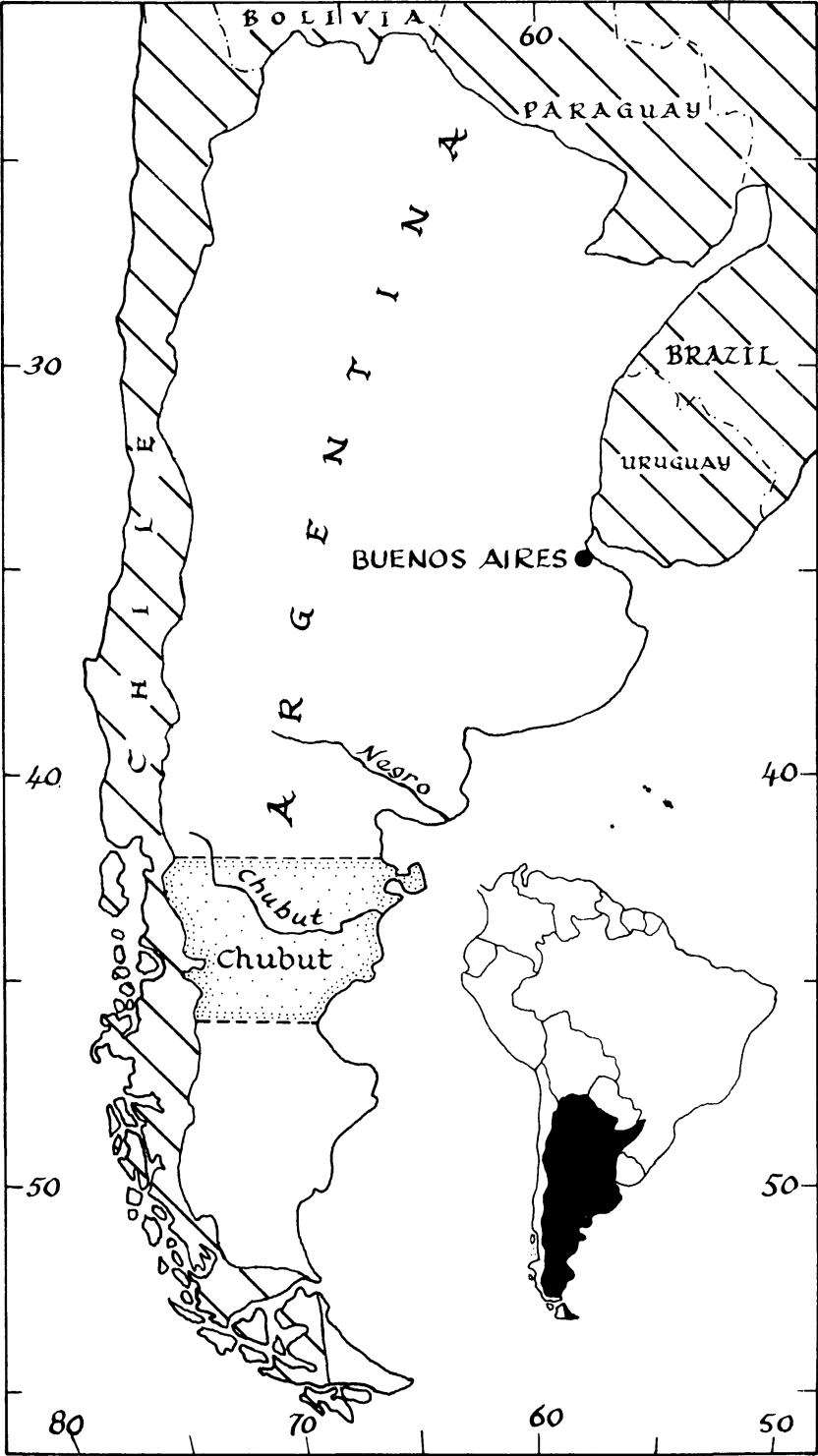


Figure 1

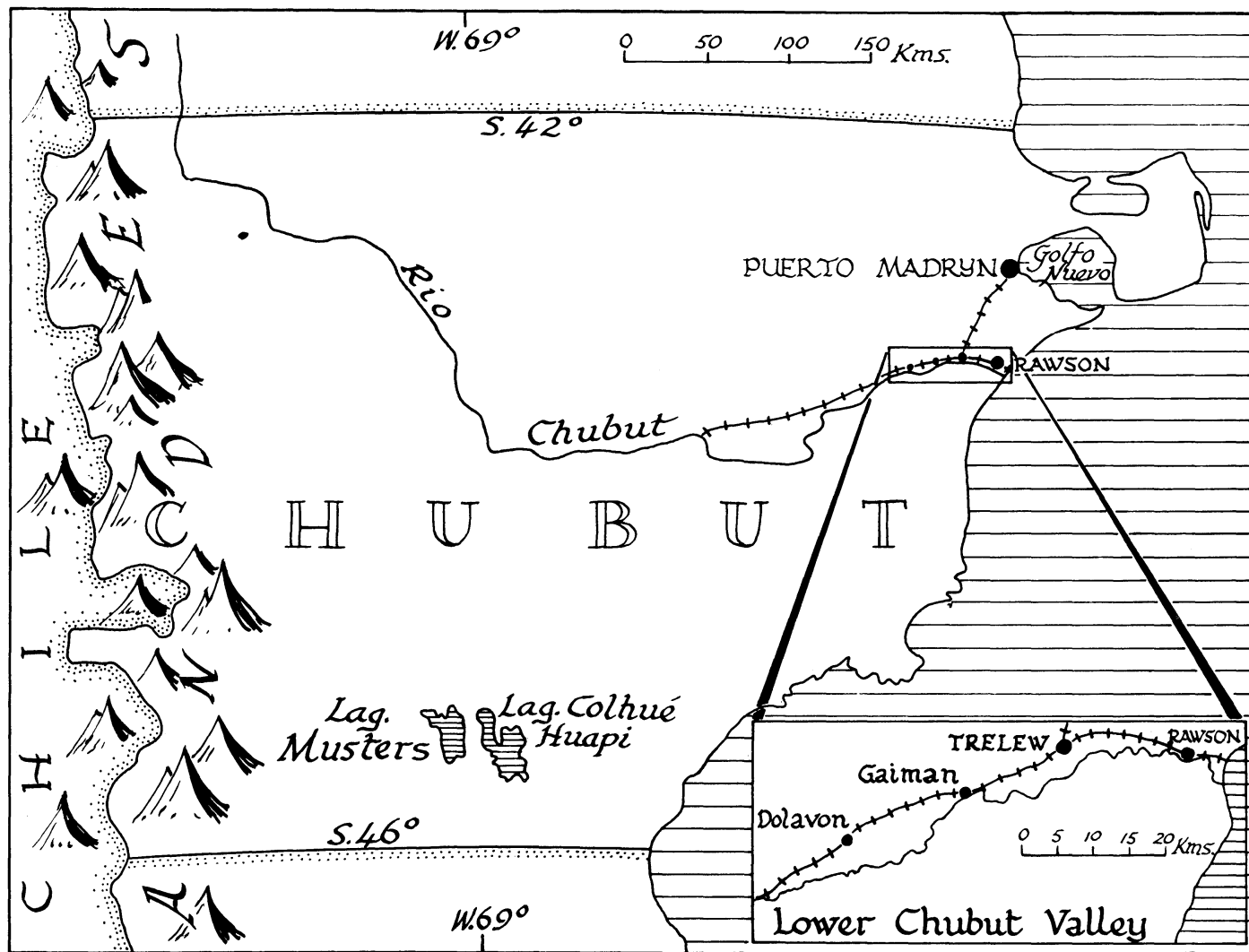
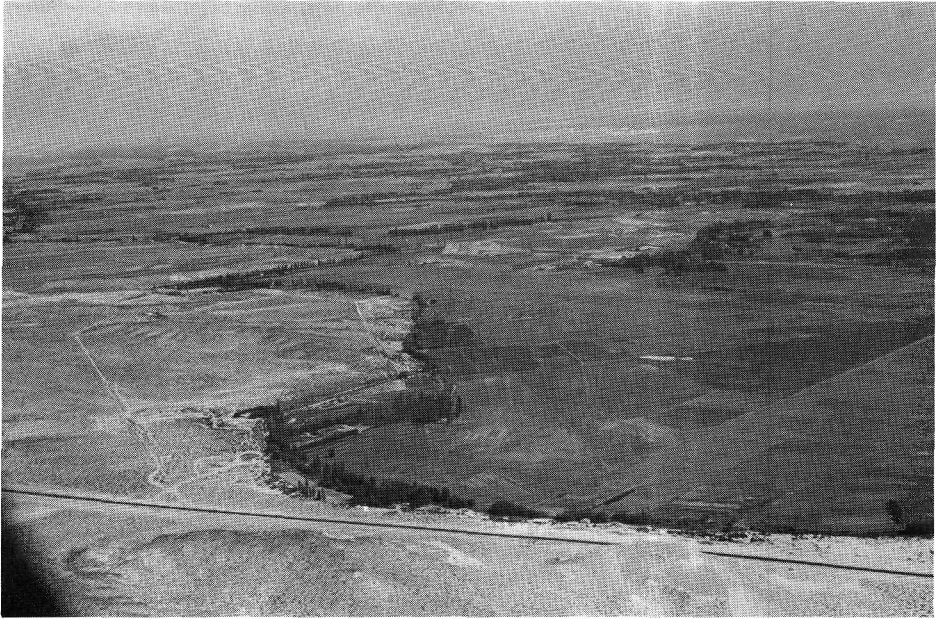


Figure 2



**Photo 1** *The irrigated Chubut floodplain contrasts with the higher, arid surface of the Patagonian Plateau.*

in 1899, 1901 and 1902 considerably worsened the condition. The soils problem then demanded the attention of all valley residents. In March and April, 1904, the Chubut Welsh language weekly, *Y Drafod*, carried (in serialized form) a perceptive analysis of the causes of declining farm productivity. It was recognized at that time that greater concentrations of salt were found in the soils after the floods than before. Some of the valley farmers perceived that this condition was related to the higher level of the ground water after the flooding. *Y Drafod* drew an analogy between the accumulation of salt on blotter paper partially immersed in pickle brine and the accumulation of salt on farm lands where the water table stood within a few feet of the surface.

Although the relationship between ground water salinity and the underlying marine deposits that comprise the Patagonian plateau was probably not understood by those early farmers, they knew that the fresh river water was good for irrigation and well water was not. It was also known that some of the valley soils had always been too saline for farming, for example those near the coast, which had never been assigned to the colonists, and a block of land in the upper valley known as « tierra salada ». Solutions to the problem involved washing the soils when the river water was at its lowest and the water table draw-down was at its maximum. « The soil that stays moist is like the blotting paper », *Y Drafod* observed. Again, in 1928, *Y Drafod* carried a series of editorials, articles and letters on the subject of



**Photo 2** *Poorly leveled fields are flooded from irrigation ditches.*



**Photo 3** *Overflow from flooded field still drains onto the public roads.*



**Photo 4** *Abandoned Welsh farm in Chubut. Soil structure is completely destroyed. In 1966 an Israeli team of land reclamation experts said that if this land were in Israel, they would not consider reclaiming it (« unless the Arabs wanted it »).*

declining farm yields. Even halting the spread of the salt condition would be of enormous benefit, one writer declared. Two main causes of high ground water were recognized : (1) seepage from canals, and (2) overwatering of farmland.

Loss of water was known to be prodigious from newly constructed canals. In one case serious leakage from a new canal on the south side of the river caused large lagoons to form on three farms, and even filled low-lying places of other farms farther down valley. Yet two years later sedimentation within the canal had so sealed it that it no longer leaked. However, the overwatering of fields was the more important cause. The Welsh arrived with no experience in irrigation procedures. Water from the Chubut River was abundantly available. The river's mean flow of 48 cubic meters per second could irrigate three times the 50,000 hectares of the Chubut flood plain where the Welsh settled. With unlimited water available for each farm the farmers carelessly allowed the water to flow lavishly onto the land. Long after a field had been thoroughly watered the canals continued to flow. The overflow drained onto a neighbor's land and onto the public roadways, making impassable quagmires of the latter. In some cases overwatering seemed necessary in order to wet the highest sections of fields only poorly leveled. Overwatering persists today in the Chubut Valley and the present water regulating authorities (the Federal Government's *Agua y Energía*) is reluctant to face the adamant opposition to reduction in water deliveries to the farms.

Another deleterious effect of the Welsh inexperience with irrigation was their failure to provide drainage canals to carry off excess water. Their system of canals simply came to an end in the lowest fields, with no provision for carrying surplus water back into the river or on to the sea.

Although by 1928 these factors were clearly recognized (and much discussed in the pages of *Y Drafod*) the Chubut Valley farmers steadfastly refused to take any necessary corrective measures. A consulting engineer brought in from Buenos Aires to advise on the problem counselled the farmers that their cooperative canal company must restrict and regulate the distribution of water to all farms. But the farmers, also the coop's members, maintained that the coop's only obligation was to convey the water to the land ; and as for the problem of the impassable flooded public roads, they viewed that as the responsibility of the municipalities. This Welsh steadfast refusal to take any initiative, even in solving this apparent and most critical problem confronting them all, was just one manifestation of Welsh character, which has underlain the steady decline during the last 50 years of Welsh influence and of Welsh identity in modern Chubut.

At present the salinity problem continues to worsen, and there is a real possibility that all cultivation may have to be abandoned in the short term future. Hectares under cultivation are declining. Of the 40,000 hectares surveyed into the original 400 farms, only 18,000 hectares were under culti-

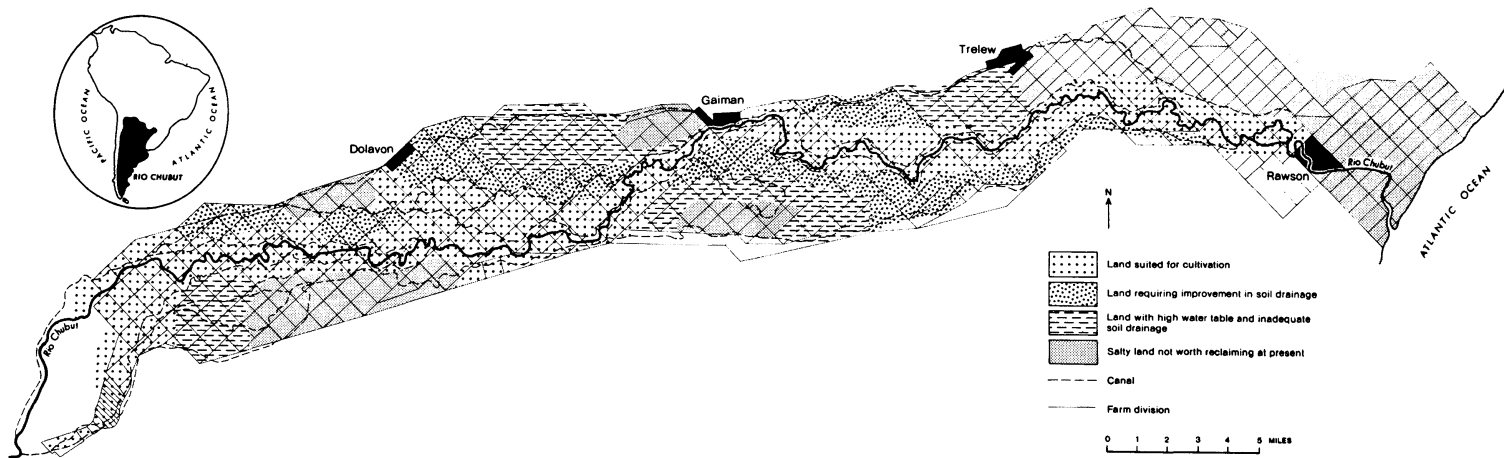
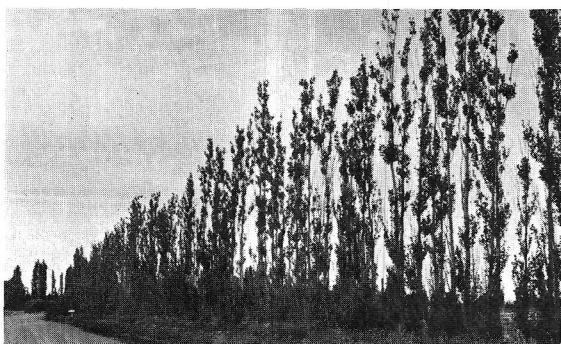


Figure 3

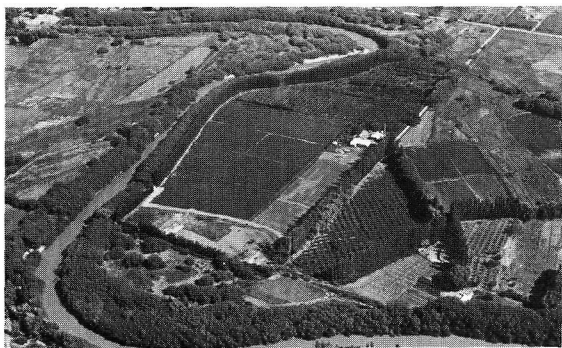




**Photo 5** *One of the first farms affected by salinization, the Hughes farm near Gaiman, abandoned in 1891.*



**Photo 6** *An unhealthy windbreak of poplars is one indicator of saline ground water near the surface.*



**Photo 7** *The remaining productive farmlands of the Chubut Valley are located along the river margins.*

vation in 1966. Conditions have continued to deteriorate since then. The best of the remaining cultivated lands are found bordering the river as shown in figure 3. These lands have had the advantage of drainage during the season of low river flow when adjacent ground water levels would drop to approximately the level of the river. Farms more removed from the river without this advantage have sustained salt accumulation. Since 1963, however, even the river border farms have been deprived of this natural benefit, for in that year the Florentino Ameghino Dam, just upstream from the head of the valley, was completed. Indeed, the new dam now insures against disastrous floods. But it also regulates the annual flow in the downstream river course. No longer does the river drop seasonally, and no longer does the water table drop in the lands bordering the river. The remaining good soils of ten years ago, estimated at about 25 percent of the farmland, are now also undergoing salinization.

The federal government, having built the Florentino Ameghino Dam, is at present excavating a few trial drainage canals to see if the water table can be lowered and the rate of salt accumulation retarded or even arrested. Treatment of the fine textured soils with gypsum to improve structure, and thereby drainage, is also a means under consideration for alleviating the problem.

In the final analysis, saving Chubut agriculture from its encroaching salty demise may be determined by economic considerations. Clearly the valley's economy locally is vital. But in the broad context of Argentina's agriculture, the potatoes, alfalfa, apples, wheat, oats, barley, onions, garlic, tomatoes and squash raised in Chubut are also produced elsewhere in the Republic, and usually at less expense. In fact, it is with much difficulty that vegetables raised in the Chubut Valley compete with those from the Humid Pampa in Patagonia's largest city, Comodoro Rivadavia. Thus, it is still uncertain that efforts to salvage Chubut agriculture will succeed.

John F. BERGMANN,  
*University of Alberta*

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