PROFESSIONAL AUTOBIOGRAPHY

OF

VUJICA YEVJEVICH

WITH ELEMENTS OF GENERAL BIOGRAPHY

Highlands Ranch, Colorado, USA
2005
PREFACE TO AUTOBIOGRAPHY

In the period 1937-1987 I was employed in two countries, Yugoslavia (1937-1958) and the U.S.A. (1958-1987). I retired in 1987. However, I have remained active as a consultant, lecturer, participant in professional meetings, etc. in many countries around the world.

Because of World War II, my work for Yugoslavia was split into three parts: (1) prior to WWII (1937-1941) I worked in Macedonia; (2) during the WWII years I was first a POW, I then spent time in hiding (1941-1944); (3) after WWII I worked in Serbia and for the Yugoslav Government (1944-1958). During this period, I did special work for Bosnia and Herzegovina.

Parallel to these engineering responsibilities, I was also a professor/lecturer of water resources engineering for 42 years, namely at the University of Belgrade (1945-1958), Colorado State University (1960-1979) and George Washington University (1979-1987). Being responsible for engineering decisions and also for the education of engineers and practical research, I was very versatile in my professional activities, both practical and theoretical. To take account of this versatility, the idea was to write a report, which is also a record of my professional activities.

For the part dealing with work in the U.S.A., I presented a report in which I outlined my contributions to the development of water resources through four institutions: (1) The U.S. National Bureau of Standards, which invited and brought me to the U.S. A.; (2) The U.S. Geological Survey; (3) Colorado State University; and (4) George Washington University.

For the part dealing with work in the Yugoslav republics, I presented reports on Bosnia and Herzegovina, Macedonia, as well as Serbia and Montenegro, all written in the Serbian language. My intention is to write a condense summary of these three reports into English and attach them to this report.

Vujica Yevjevich
CONCEPT ON HOW TO PRESENT YEVJEVICH'S CONTRIBUTIONS TO THE PROFESSION

Only four of today's countries may rightfully claim Professor Vujica Yevjevich as an employee of one or more of their domestic and/or international institutions. In time sequence they are: (1) The former Yugoslav Republic of Macedonia; (2) Serbia and Montenegro; (3) Bosnia and Herzegovina; and (4) The United States of America.

Apart from these four countries, any others can make somewhat comparable claims, albeit on a different level and with a different context. For instance, Yevjevich worked closely with countless professionals from all over the world. He guided some 200 students, 701 diplomas, 80 M.S., and 50 PhD engineers from all of five of the inhabited continents of the Planet. He worked for, and with international institutions such as the United Nations and NATO.

Having consulted with professional colleagues, family members and former students, Yevjevich decided to evaluate his life's work as best as possible in the form of two autobiographies:

1. Professional autobiography.
2. Personal autobiography.

These two autobiographies should be mutually complementary, but they may also stand as two separate autobiographies, independent of each other.

Yevjevich's work plan for his professional autobiography (A-D) and his personal autobiography (E) has been structured according to the following action steps:

A) The Yugoslav reports.

First, the three reports on Yevjevich's contributions to Macedonia, Serbia, and Montenegro, Bosnia, and Herzegovina will be written in the Serbian language, in order to obtain feedback from the corresponding colleagues.

B) The English version of these 3 reports.

Once re-written, the Yugoslavian reports will be translated into English.

C) The U.S.A. report.

The report on Yevjevich's contributions to the U.S.A. will be reworked by the Civil Engineering Department of Colorado State University, Ft. Collins, Colorado.

D) The International Report.

The fifth report (this one) covers Yevjevich's global contributions in more than 60 nations around the world.

E) The personal report.

This will cover Yevjevich's non-professional experiences throughout his life.
AUTOBIOGRAPHY OF VUJICA YEVJEVICH

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GENERAL BIOGRAPHY

OF

VUJICA YEVJECH

PART I

Higlands Ranch, Clorado, USA
2005
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1. INTRODUCTION

1.1 The initiative for writing this autobiography. At my retirement party in 1979, colleagues at Colorado State University (CSU), Fort Collins, Colorado, USA, suggested that I collect my printed professional and scientific works, and bind them into volumes, with the first volume prefaced by an autobiography. I decided to give sequential numbers to each paragraph starting from one for each chapter. This was done regardless whether the paragraph is small or large. The reason for using these numbers is to enable the reader to reference my autobiography or to select its parts of interest for reading. Two sets of five hardbound volumes of reprints or copies of my original papers were assembled and bound. One set was deposited at the Library of Colorado State University, while the other was given to me. From this initial step, several updates were made, up to distinguish two dependent but different autobiographies, one the most general and this one, basically covering 60 years of professional activities.

1.2 Approaches used in writing autobiographies. Various types of autobiography and different approaches are used in writing them. I selected the type of autobiography which is dominated by my 60 years of professional activities and accomplishments. Then I followed the chronological approach in presenting the biography of my life. It was divided into five periods of time. The reason for choosing these methods is that they provide a better focus on the environmental and cultural influences on my life and on my professional activities. Also, in reading the description of my life's accomplishments, using this approach, may be more attractive to a reader than any other method of presenting the facts of life.

1.3 Division of life into five major periods of time. The five major periods of my life were (1) from my birth on October 12, 1913 in Yugoslavia, to the Second World War events in 1941; (2) the coming of the Second World War to Yugoslavia, with the war lasting from April 1941 to October 1944; (3) life in postwar Yugoslavia, from October 1944 to January 1958; (4) life in the United States of American from the arrival to the USA of February 10, 1958 it the 65 years compulsory age of retirement from Colorado State University in August 1979; and (5) the life period in the United States from September 1979 to the last updating of this type of autobiography, with the date of finishing the last update given. I found this approach easiest for me to use in writing this autobiography.

2. MAJOR FIELD OF LIFELONG WORK AND RESEARCH

2.1 Military service and initial engineering work. After graduating from the University of Belgrade in September 1936, I went into the regular military service for engineering graduates, in the School for reserve engineering officers of pre-war Yugoslavia, during the period of October 1936 to July 1937. Following that service, I worked at various engineering assignments in Belgrade, September - December 1937 to culminate as the hydraulic engineer in the regional governmental engineering office in Skopje, Macedonia (a part of Yugoslavia in 1937, now an independent state). During the period of December 1937- September 1938, I was engaged in versatile hydraulic engineering works, consisting of field work, design, construction, supervision and similar activities, related to water supply, irrigation, flood control, river training, drainage, small hydroelectric power plants, etc. It was a period in which I made a solid bridge between the school knowledge and engineering practice.

2.2 Studies in France and England. I won a fellowship from the French Government for one year of studies in France. I attended from September 1938 to June 1939 the School for Hydraulic Engineers of the University of Grenoble, France for one school year. I graduated in 1939. In fact these studies represented an equivalent ME, the master in hydraulic engineering. During the period June- August 1939, I worked two months in a soil mechanics laboratory in Paris. My three week visit to Great Britain, in August 1939, was to tour British hydraulic laboratories (Birmingham, London, Edinburgh, and others). In crossing the English Channel at that time, I had in my possession the book "English in 100 Lessons" (with Serbo-Croatian language used to explain the
English language), which ultimately induced me to start learning the English language, symbolically staring it by visiting a friend who was studying in England.

2.3 Return to Yugoslavia. When Great Britain declared war on Hitler's Germany on September 1, 1939, I happened to be in England, at Trafalgar Square in London. The radio announced that England has declared war on Hitler's Germany and Mussolini's Italy, after Germany invaded Poland. Deep silence of the large crowd of people at the Square, upon hearing that their country was already at war, made a lasting impact on me. I felt intuitively that this event would greatly influence my immediate future. That night, I was one of the small numbers of passengers crossing the Channel by boat between Great Britain and France. Returning to Grenoble, I packed my belongings and crossed Northern Italy by train before Mussolini's Italy declared war on France and closed their border traffic.

2.4 Engineering activities and arrival of the Second World War to Yugoslavia. I returned to Skopje, Yugoslavia to my job from which I had taken a leave of absence for a full year. While the Second World War was taking its course, first in Eastern Europe (Poland) and then in Western Europe (Norway, the Low Countries and France), the uneasy life due to this war continued in Yugoslavia. I worked as the engineer in charge of a special section for planning hydraulic works in the basin of the Vardar River; the works included river training, flood control, drainage, irrigation, hydroelectric power as well as other types of work (water resources, planning, design, and construction). I was mobilized in March 1941 after Yugoslavia declined to join the German-Italian Axis. In the swift invasion of Yugoslavia by Germany, Italy and their satellites (mainly neighbors of Yugoslavia) in April 1941, most of the Yugoslav Army had to surrender to overwhelming forces and military superiority. Most of us located close to the invasion routes and resisting the invasion, were made prisoners of the war in April 1941.

3. WAR PERIOD APRIL 1941- OCTOBER 1944

3.1 Prisoner of war. Even the relatively brief war activities in Yugoslavia in April 1941 brought tragedies of various kinds and degrees to the peoples of Yugoslavia. The military engineering unit, in which I served as a reserve officer, was encircled by German tanks near Skopje in the present-day Former Yugoslav Republic of Macedonia. That was my start of a relatively long ordeal as a prisoner of war. In some way, however, I was fortunate. Germany and Italy recognized the Geneva International Convention on Military Prisoners of War, so I finished as a reserve officer in camps that did not require prisoners of war to work physically as was the case with other military. That Convention enabled me to work physically as was the case with other military. That Convention enabled me to put my two and one-half years (April 1941 to September 1943) of my prisoner's life to most beneficial uses.

3.2 First days as a prisoner of war. The transport of prisoners of war took me through Bulgaria, Rumania, Hungary and Austria into Germany. During that trip the curious higher German officers and officers of their satellite states, could not grasp the rationale of why Yugoslavia made such a suicidal opposition to the great military powers of Europe. In a frank exchange of views, a German general could not figure out why all of the Yugoslav officers-prisoners of war, and mainly of Serbian nationality, were deeply convinced that the European Axis would definitely lose the Second World War to Allied forces. We had been only guessing whether we would be in prison camps, five, six, seven, or more years. When the United States of America declared war on Japan, after the Pearl Harbor attack, and then on Hitler's Germany and Mussolini's Italy, we would only revise the projection of our time in prison camps to 3-4 years. That was a fairly accurate prediction in December 1941.

3.3 Prisoner of war in Germany. Life of prisoners, in several prisoners' camps in which many of us had been moved around, was very hard, because of restrictions in food to non-working prisoners. During these first eight months, I lost more than 35 percent of my normal weight. Faced with a lot of time on my hands, I used the "camp money" (by the Geneva Convention
officers-prisoners of war must be paid a salary) to purchase any recent technical book available in the German language in water resources related area, as well as books for learning languages. That kept me very busy.

3.4 Prisoner of war in Italy. Fortunately, since I was born in the province of Yugoslavia, which was occupied by Italian troops in December 1941, I was transferred into an Italian prisoners camp, my interpretation was that the transfer resulted from German request to have Italy feed some prisoners of war, particularly those who did not have to work according to the Geneva Convention. This transfer and the two changes of camps in Italy meant better food, warmer climate, easier southern attitude of the Italian military camp guards, faster movement of food parcels either from our homes or from the International Red Cross (these parcels were basically of American origin). Better treatment was such as getting movies into the camp, receiving Italian newspapers, sometimes groups being escorted to church service, or brief guarded walks outside the camp. When it was my turn to translate news from the Italian newspapers, because of my knowledge of Italian language, the Serbo-Croatian version of news was in essence a translation followed by an interpretation. As an example, if the translation was at the X-front our troops were correcting the long lines, the interpretation would be like: the troops at the X-front lines are in a complete withdrawal. We considered our transfer from the German prisoner's camps to the Italian camps a privileged situation, regardless of changes of three Italian camps (Fiume, Sulmona, and Cortemaggiore).

3.5 Use of time in the prisoner camps. The period of time from April 1941 to September 1943 (about two and one half years) was for me like going to a prestigious engineering school for the double master degrees, M.S. (master of science) and M.E. (master of engineering). I digested about 30,000 pages of professional books in German and Italian languages (English, Italian, Russian, German), and read any general book of my interest that I could obtain. The hard war times because a forced educational bonanza to me.

3.6 Travel to Rome after leaving the prisoners camp. When Mussolini's Government capitulated to Allied forces in September 1943, we induced our Italian commander of the camp at Cortemaggiore in Northern Italy (a Monastery facility adjusted for the temporary prisoners-of-war camp), to release us from the camp prior to the arrival of German troops to re-occupy the camp. The Italian commander did it just in time. A fellow prisoner of war and I spent a couple of days in a farmer's house nearby, sleeping in his barn. We procured civilian clothes and Italian personal documents, with Italian names. My selected name was Giovanni Bossera, an Italian from Tunis, speaking Italian and French. That fellow prisoner and I went to Rome, expecting the Allied forces to enter Rome soon. That was a miscalculation. It forced me to live in Rome under German occupation from September 1943 to June 1944.

3.7 Life in Rome under German occupation. The nine-month stay in Rome represented a relatively pleasant life with a continuation of my learning languages and of studying Italian technical literature in a hideout apartment in Rome. With the fluent Italian language and many Italian friends, the war often seemed to me very distant indeed. This occurred regardless of the vicinity to the Cassino battle front for many months and bombardment from time to time of military targets in the suburbia and surroundings of Rome. The Yugoslav Government in exile in London.

3.8 Return to Yugoslavia and the end of military duties. The entrance of Allied troops into Rome and the agreement between the Allied military command and the new Yugoslav communist authorities resulted in my transfer, with the other prisoners of war, to the Yugoslav military camp in Gravina near Bari, Italy in June 1944. Soon after, I was sent to the Island of Vis in Dalmatia, where the Provisional Yugoslav Government had its liberated territory. As a hydraulic engineering specialist, I was transferred there to work in the general preparations for the post-war reconstruction of highly destroyed areas in Yugoslavia during the war. The U.S. Air Force transported us to Belgrade, Yugoslavia in October 1944, and it was the end of my military status.
3.9 Transition from war to peace duties. My assignments in the transition from war to peace duties were to but tools, repair equipments and materials in the less destroyed areas of the country. I will never forget the passage through the small town Prozor in Bosnia. Not one house was undamaged. On the ruined walls I could distinguish inscriptions of non regular or irregular armies passing through and/or fighting the occupying unfriendly unit. All of them left their “signature paroles” on the walls. In some parts of Yugoslavia, controlled by Russian troops, I needed lots of strong plum brandy, “shlivowitz", to get the permit to buy tools and repair materials and to take them out of the Russian controlled areas. The transition from life of a military man and all the psychological impacts of life as a prisoner of war, or one who escaped from the prisoner camp, hid in Rome, to a civilian professional engineer was relatively risk-free event.

4. PERIOD OF LIFE AND WORK IN YUGOSLAVIA FROM OCTOBER 1944 to FEBRUARY 1958

4.1 Return to Belgrade and initial professional activities. This period of 14 years presents initial professional activities in post-war Yugoslavia. First, I was an engineer in the Ministry of Public Works of the Republic of Serbia. Serbia was planning the reconstruction of war-damaged public facilities, as well as carrying out regular hydraulic engineering activities. Then, at the beginning of 1945 I was transferred to the new Electrical Power Authority of the State of Serbia. The State of Serbia was a part of the Federation of Yugoslavia. My basic working tasks were determined by political leadership. They required the establishment of a good design organization, called Hydrobiro, for both the river basin planning and the design of hydroelectric and thermoelectric power plants.

4.2 Additional educational and research assignments. In 1946 I was asked to teach two courses, hydrology and hydroelectric power engineering at the University of Belgrade, Civil Engineering Department (or "Faculty", the terminology used in many European countries). I taught those courses for 11 years (1946-1956) as an affiliated teaching staff member. The Serbian Hydrobiro was incorporated in 1947 into the new Federal planning and design organization for hydroelectric power plants of Yugoslavia, of which I was deputy director for a short period of time. In 1948 my assignment was to develop Hydraulic Laboratory at the foothills of Avala Hill, 20 kilometers from Belgrade. I was appointed director of that laboratory. At the same time, I became deputy director of the newly established Federal Electric Power Research Institute.

4.3. Research and other professional activities. From 1948 to 1956 I was basically associated with research, apart from a very active participant as the major consultant in planning, design, and construction of hydraulic structures. A special basic and applied research institute for water resources was created in 1949, of which I was director until the spring of 1956. Activities in the Institute varied from hydraulic modeling, advanced hydrologic investigations and research on river basin planning. Furthermore, Institute was to search for solutions of technological problems in design, construction and operation of hydroelectric and other power plants. I was given two medals and a citation awards by the Yugoslav Government in recognition of my contributions in these post-war activities.

4.4. Broad aspects of professional work. In the period 1945-1956, I was actively involved in the planning of many river basin water resources development schemes in Yugoslavia, especially in its eastern, central and southern parts. Then, I became involved as a consultant in advising and reviewing designs of dams, tunnels, hydroelectric power plants and other hydraulic structures. Stress was on applied research and technology development, especially those needed for the decrease of risks or maybe too costly without these investigations. This was especially important in applied research and development of better technologies that were needed in carrying out the program of electrical power and water resources developments.
4.5 Transition from applied to basic research. The economic development of Yugoslavia needed a transition from an elementary applied research and technology development to a combined basic and connected applied research and development. Transitions from planning, design, field investigation, indirect supervision of construction and field testings, to studies of basic and applied research, was a welcome decision to me since these were subjects for which I was well prepared. Involvement with teaching at the University of Belgrade fitted well this assignment. The new direction of work resulted in my very rapid acquisition of versatile experience and professional standing. I felt as if I had become an engineer-scientist, leaving the design or construction engineering role. Coupled with consulting in Yugoslavia and abroad, and world-wide contacts with professionals and scientists in water related fields via symposia, conferences, seminars, workshops, correspondence and visits to many countries in Europe and a two month visit in the United States of America in 1953, further reinforced my engineering and scientific production and reputation. A keen reviewer of my published papers (around 200 in total) and 14 text and proceedings books, could distinguish these transitions by the type and quality of the published research papers. From a mixed use of languages of my papers prior to 1958, to the use mainly of English and good professional journals, as the transitions required.


4.7 Degree of Doctor of Engineering. In 1955, I submitted a doctoral thesis on the methodology of investigation of hydropower potential to the Serbian Academy of Sciences and Arts, which awarded me the degree of Doctor of Engineering. At that time in Yugoslavia, awards of doctor degree by academies of sciences were considered to be a higher standing than similar degrees awarded by universities. I was the first and the last hydraulic engineer to be awarded that degree of Doctor of Engineering by the Serbian Academy of Sciences and Arts. The chairman of my doctoral committee was Dr. Mulutin Milankovic, Academician. His work on three orbital astronomical cycles of the Earth, as deterministic processes, inspired me later in the U.S.A. to study them as the combination of the equally important signal and noise components of the process.

4.8 Publishing in post-war Yugoslavia. A large number of professional and scientific papers resulted from my activities in the period 1948-1956. I also wrote and published in that period three books: "Water Resources Schemes" ("Vodoprivredna Osnova", in Serbo-Croatian), "Hydrology" (also in Serbo-Croatian), and "Water Power Resources of Yugoslavia" (in two languages, English and Serbo-Croatian).

4.9 Leaving the institute. In 1956 I left the Water Resources Research Institute of Belgrade, Yugoslavia, and became the chief advisor for water resources and hydropower problems in the newly established Union of Yugoslav Electric Power Authorities, where I worked until January 1958. One of the reasons for leaving the Institute was my disagreement with the communist party unit in the Institute on some basic issues. The staff members of the Institute overwhelmingly defeated the positions of the party unit when on those issues the employees of the Institute voted. It was easily resolved by my leaving the Institute.

4.10 The United Nations mission to Southeast Asia. Meanwhile, I spent four months as an advisor to the Commission for Asia and the Far East (ECAFE) of the United Nations, Bangkok, Thailand (May to September 1957). My task was the organization of the seminar on my approach and methods for estimating regional hydropower potentials. Engineers and hydrologists from Asian countries and some from other regions of the World attended this seminar. Especially it was an important seminar for countries rich in hydropower but with the relatively limited natural fuel resources. Also, I visited Burma and India on the ECAFE’s assignment, primarily to assess how these developing countries utilize their best professionals in water and power developments. I found that the best engineers were "pushing papers", since the remuneration of administrators
was much more rewarding than of the engineers. Returning to Belgrade from the U.N. mission at the end of September 1957, I needed all the patience I could master until January 1958 when my family of five finally was granted the exit from Yugoslavia for traveling to the U.S.A, and not only for myself.

5. PERIOD IN U.S.A FROM FEBRUARY 1958 TO AUGUST 1979 (DATE OF RETIREMENT FROM COLORADO STATE UNIVERSITY AS PROFESSOR EMERITUS OF CIVIL ENGINEERING).

5.1 First visit to the United States of America. During the 1953 Minneapolis Congress of the International Association for Hydraulic Research, which I attended on my first visit to the United States, I met several U.S. colleagues of the same professional and scientific interests. I also visited some of them in my post-congress, two-month tour of laboratories, field works, universities and governmental agencies of the United States. How much that travel made an impact on me can be shown by the fact that upon my return to Yugoslavia I delivered 12 lectures to colleagues and the Institute's employees, half on professional subjects and the second half on my general impressions of American people and life in the United States.

5.2. Invitation to visit the U.S.A. as a guest scientist. Among the colleagues whom I met at the Minneapolis Congress and/or visited on my tour of the U.S.A., especially in Washington D.C., was Dr. Robert F. Dressler, at that time the acting director of the National Hydraulic Laboratory, the U.S. National Bureau of Standards. We maintained contacts through an exchange of reprints of published papers and by Christmas and the New Year's greetings. He visited me in Belgrade in 1955. In 1956, on Dr. Dressler's initiative, the U.S. National Bureau of Standards invited me to come to the United States as a visiting scientist for an 18 month stay and joint research in fluid mechanics, hydraulics and hydrology.

5.3 Second visit to the United States. It was not easy for me to obtain an exit permit from Yugoslavia for that invited visit. A further difficulty arose from the fact that I was among the first Yugoslav professionals to be invited as a visiting scientist by a United States agency. That was the period of time when the Yugoslav authorities, under the technical assistance program from the United States, were only committed to sending the Yugoslav engineers and scientists for learning and training in the United States. In a long discourse with the Yugoslav authorities, which were mainly inclined to allow me to leave without my family, they finally permitted me to travel with my family to the United States. We arrived in New York City by ship (Queen Elizabeth) on February 10, 1958. Our intention was to return to Yugoslavia after the invited 18 month visit and professional research work expired. My task was to do research with staff members of the Mathematical Physics Section of the U. S. National Bureau of Standards, headed by Dr. Robert F. Dressler. A Yugoslav University colleague, a mechanical engineer by education, but the leader of economic affairs of Yugoslavia at that time, told me the following on the question of permission to go to the U. S. A. with my family for a year and a half; "When you discover America, and America discovers you, you will not come back". My answer was "Maybe yes, maybe no", because it will depend on sides, meaning the Yugoslav Government and myself.

5.4 Research work for the U.S. National Bureau of Standards. I worked for the U.S. National Bureau of Standards in the 16 month period from February 1958 to June 1959. My office was located at the American University, Department of Mathematics and Statistics, Washington D.C., under a contract between the two institutions. My major research was water outlet waves of dam breaches. The second research topic was the analysis of time series of annual precipitation and annual runoff, both topics under the contracts of the National Bureau of Standards by other agencies of U.S. Government. The largest existing computer, located at the Bureau at that time, permitted me to extend my previously initiated studies on stochastic processes of hydrology much before I came to Washington D.C. That coincidence of factors likely had an influence on selection of two of my future specializations in research in the United States, the unsteady free-surface flow and the stochastic hydrology with the related mathematical statistics and probability theory.
5.5 Work in the U.S. Geological Survey (U.S.G.S). The U.S. Geological Survey, Washington D.C., showed an interest in my work for the Bureau during the first half of 1959, and invited me to spend another 14 months as the senior visiting scientist in the U.S.G. S Research Section of Surface Water Branch, Water Resources Division, Washington D.C. During that period of time, I produced a report with a very extensive annotated bibliography on unsteady flow in open channels (under an interagency contract with the U. S Geological Survey). That work, later published by U.S.G.S. as their special publication, further influenced my areas of professional specialization. By continuing the previously initiated research at my forthcoming university career in the United States. The unsteady flow in open channels in hydraulics was my known specialty. Physical and stochastic processes of hydrology, especially time series analysis, required the application of advanced mathematical statistics to both, hydrology and water resources. Those research topics were reinforced by doing research and working with the U.S. Geological Survey from July 1959 to August 1960. During that period of time, the dilemma arose, namely whether to return to Yugoslavia or to stay temporarily or permanently in the United States of America.

5.6 Dilemma whether to return to Yugoslavia or to stay temporarily or permanently in the United States. Several inquiries from the engineering schools, and later from the larger universities, institutes of technology and state universities or U.S.A., whether I would be available to join their faculty under various offers for working arrangements, contrasted with the ambiguous attitudes of Yugoslav authorities about my future as a scientist and educator. Those attitudes were shaped by envious if individuals of low scientific and professional capabilities. They were politically well placed in Yugoslavia. One of the tragedies, power of mediocre scientists in those dictatorially countries was sufficient to overrun big differences in scientific and technical competence. My offer to return to Yugoslavia was not answered by the political leaders of Serbia. I responded to the urging of the President of the University of Belgrade, during his official visit to the United States. He invited me to apply for the position of full professor of Civil Engineering at the University of Belgrade. This did not result in what I thought I deserved considering my qualities as a person, professional man, educator and scientist, along with my outstanding contributions to the developments in Yugoslavia in all three fields: engineering profession, science and education during the 14 year period, 1944-1958, and the valuable contributions to development of water resources and hydroelectric power of Yugoslavia.

5.7 Other factors supporting the decision to immigrate to the U.S.A. The contributing factor to seriously consider the decision to temporarily or permanently stay and work in the U.S.A. and to eventually change my status from visiting scientist to immigrant engineer-scientist was the advice and pleading of my visiting mother with both my wife Mirjana and myself, not to return to Yugoslavia at that time. At this crucial moment, I also took into account the fact that I lost my father in 1945 to the politics of the Communist Party of Yugoslavia "in their crusade to liquidate the national activists", which included my father. I also lost my brother in 1945 as he was brought to mental breakdown under the pressure of communist activities in the Yugoslav Army. I also lost my son of my first marriage in 1947 by infection under low medical conditions of public facilities for the "ordinary people". Several years later, I received information from my relatives in Sarajevo, Bosnia, which retroactively confirmed the wisdom in our decision to immigrate to the U.S.A. My first cousin was one of the leaders of the communist youth organization in the Republic of Bosnia. At a visit of the youth leaders with Tito, he was asked by Tito whether he was related to me. The answer was, "we are first cousins, the sons of two brothers". Then Tito told him, that I had done everything possible within my power for the country but the country did not give me anything in return. He repeated the same statement when his war courier asked him to let him go study with me in the United States.

5.8 Immigrants. Ironically, I never felt or have considered myself to being either in the brain-drain army leaving the communist paradise, or a political immigrant. Rather, I felt the immigrant who can offer something valuable to the United States and at the same time find the conducive conditions for productive and creative work. My country of origin refused to offer them to me.
because of political prejudices and monopoly of the party machine. I was one of the best paid engineers in Yugoslavia, not only by the salary of the regular job but also because of several consulting retainers from power companies and a teaching honorarium from the University. The decision to stay, work, and adjust in the U.S.A. was not economically motivating. It was in some ways my survival as a scientist and productive engineer at that time. The privileged bureaucratic, technological and educational casts of Yugoslavia could not tolerate an independently minded individual who had already contributed much in the past, and would have much more to offer to his country of origin in the future. How many European and/or world-wide scientists and engineers had to follow the similar paths as I did belong to the history of immigration to the United States?

5.9 Joining Colorado State University. I elected to join Colorado State University in Fort Collins Colorado on a temporary appointment as the research civil engineer in September 1960. The "temporary appointment" meant that I was expected to raise the research money by excellent research proposals, with the trust by sponsors that the major project research objectives will be either fully accomplished or over-attained. The dilemma for me was between that alternative and an offered temporary position in a well-established U.S. university or institute of technology. That decision proved to be a correct one. The Colorado State University (CSU) accepted my two conditions for joining it without hesitation, namely: to petition for me and my family for the immigration status, and never to ask me to accept an administrative position within the university. Both have been delivered, the first one on the short run, and the second one on the long run, of my 19 years of full time association with CSU, 1960-1979. First I had in mind to assure that I would stay a scholar, professional engineer and engineer-scientist for the rest of my life. Second, I was often disappointed to see how some of the best scientific brains of America high educational establishments eagerly plunged into the administrative position which rapidly decreased their scholarly creativity and productivity.

5.10 Building a university and within it the graduate and research programs. It was necessary in the 1960’s to build a modern university starting from a small agricultural and mechanical land-grant college, just turned into a university by name but not yet by substance when I joined it. I always felt proud of being one of several such builders of the university during the two decades of my association with Colorado State University (CSU). Soon after I joined CSU, the Department of Civil Engineering entrusted me with the task of establishing a graduate and research program in hydrology and water resources. It was logical that the dry climate, with modest rainfall and snowfall in areas of the arid West of the U.S.A., would need the best water resources planning and development by the most advanced scientific and engineering knowledge and technology.

5.11 Water resources and the new University. Several of us CSU professors, with specialty in hydraulic engineering, environmental technology and various aspects of water engineering, jointly built the good quality graduate academic and research and versatile research activities in water resources areas. Likely, this was, and probably still is, one of the largest water resources graduate and research programs in the world. It may also be the best such university programs for disciplines related to water resources. I never asked for the position of full professorship, or leadership of a program, or the tenure status, or for salary raises. All of them were given to me by the initiative of Civil Engineering Department, College of Engineering and University. I have received the first CSU Andrew G. Clark Award for excellence in research. This was done for my role in building the university, in general, in recognition of my contributions to education, science, and professional services and in operating the water related program, in particular.

5.12 Role in forming and operating a graduate and research program. I taught mainly graduate level courses (M.S. and PhD Degrees oriented) in hydrology, with the applications of the probability theory, stochastic processes and mathematical statistics to hydrology and water resources. I wrote and published a large number of papers and several books on these subjects. During my 19 years of tenure at CSU, I guided about 50 PhD and about 50 M.S. graduate students, as their major professor, academic advisor and chairman or member of their graduate
commitees. Versatile contributions to Hydrology and Water Resources program at CSU by graduate students, professors and visiting scientists were also published in the 100 Hydrology Papers of Colorado State University, in the period of 1963-1980, of which I was editor and one of the major contributors. Condense and shorter versions of many of these CSU Hydrology Papers were published in referee journals.

5.13 Academic quality and performance of graduate students. The graduate students at CSU came from the United States and from various countries of all continents. At present, many of those who graduated at CSU under my guidance are at very high academic and professional positions, as leaders in their disciplines, both in many countries of the world and in the United States. I was often asked by CSU leaders what it is behind the fact that my graduate students have preformed surprisingly well in their post-university professional carriers in their countries. It looked as if they performed better, on the average, than some of their colleagues. My answer usually was that I have been interviewing my graduate students very carefully before proposing to the teaching or research assistantship. I tried to emphasize good qualities of candidates and minimize bad ones as much as the system permitted. I taught my students not only professional subject matter, but also indirectly the influence of integrity in professional performance, role of hard work, in taking risks when conditions require a person to take them (after the evaluation of available information). The results at CSU reminded me often of my diploma-graduating engineers at the University of Belgrade, Yugoslavia. About 75 engineering students at the Civil Engineering Department graduated between 1946 and 1956 by working under my guidance on practical hydraulic engineering projects and defending their solutions as the precondition to receiving the undergraduate engineering diplomas. They had, on the average, the same successful professional performance in Yugoslavia as the graduate Ph.D. and M.S. students at CSU did in the U.S.A. and world wide. In my judgment, nothing should be more rewarding to a university professor than a life performance of his of her students.

5.14 Contributions to the country of origin. I felt that I did not owe anything to the communist political establishment of Yugoslavia. However, I do not feel the same of the people, particularly of the young generation of college age of my country of origin. I have contributed, in the period 1958-1998 (40 years), to my country of origin in several aspects of my profession. Five Ph.D. and one M.S. student candidates from Yugoslavia have received financial support to study at CSU from research projects awarded to my research programs. Another four candidates for Ph.D. from Yugoslavia studied at CSU under my advice, with CSU supporting them financially from my research grants and contracts. They worked towards their doctor's degree (obtained upon their return home at the Yugoslav universities). I consider them also as my educational contributions for making bridges between Yugoslavia and the United States through an unselfish cooperation. I have kept continuous contacts with scientists and engineers of Yugoslavia by delivering invited lectures, by consulting activities, usually by invitations from the scientific and engineering associations, research institutes, consulting firms or agencies of Federal and state governments of Yugoslavia, and by the other ways of helping young professionals and technical institutions.

5.15 International activities. My international activities during my life in the United States of America were very productive in general aspects of professional work. Cooperation with colleagues of the University of Catania, Italy (which extended over a 10 year period 1971-1981), the University of Padua (lecturing twice at the International Postgraduate Course in Hydrology), and several other organizations in Italy, were mutually beneficial to out institutions. A large bilateral project on karst hydrology and karst water resources with Yugoslavia, sponsored by the U.S. National Science Foundation and the research support sources of Yugoslavia, extended over an eight year period (1971-1979). A U.S. Spanish project on conjunctive use of various sources of water, sponsored by the Bilateral U.S. Spanish Committee, lasted more than five years. These are the largest of many other similar, but smaller cooperative research projects with which I was involved as the U.S. project co-director and one of major U.S. contributing researchers.
5.16 Bilateral professional meetings. Bilateral symposia, often initiated and organized by myself, such as the U.S. Japanese seminar on systems approach to hydrology, the U.S. Yugoslavian symposium on karst hydrology and water resources, U.S. Argentinean workshop on droughts, U.S. Uruguay bilateral meeting on small catchments hydrology, and other bilateral conferences, are examples of international cooperation. I was instrumental in bringing to Colorado State University the 1967 Congress of International Association for Hydraulic Research, and the three international symposia on hydrology (1967, 1972, 1977), apart from several summer short courses and institutes that I organized and/or participated in as the author or co-author of papers.

5.17 Short international invited visits on lecturing and consulting missions. My international lecturing tours, or short visits, usually delivering invited lectures (apart from many such cases in the United States) included Australia (four times), New Zealand, Thailand (several times), India (a few times), Taiwan, Philippines, Indonesia, Japan, Lebanon, Tanzania, Uganda, Ethiopia, Republic of South Africa, Kenya, Brazil (several times), Argentina, Peru, Columbia, Venezuela, Mexico, Canada, Sweden (several times), the Netherlands (several times), France (several times), Italy (many times), Yugoslavia (dozens of times), Hungary (many times), Israel, Turkey (several times), Poland, Spain, Portugal (couple of times), Great Britain (several times), Federal German Republic, Austria, China (three times, including a full course on stochastic processes in hydrology at the Chengdu University, with 150 participants from all over China), USSR, and others. I spent three months during the summer of 1971 as the Fulbright Scholar at the Technological Institute of the University Of Lund, Sweden, and delivered a full course on stochastic hydrology. In 1974 that University awarded me the degree of Doctor Honoris Causa. In 1974, I gave a full course on stochastic hydrology at the University Of Sao Paulo, Brazil. I also visited the Peoples Republic of China as a member of the U.S. four members official governmental delegation. The U.S. Department of Agriculture, Soil Conservation Service "borrowed me" from the George Washington University for that one month mission. The mission was to assess how good the advanced Chinese specialists have been at that time in water resources planning and in soil conservation.

5.18 Consulting activities. Consulting services at the highest professional levels, both in the United States (to Governmental agencies, private corporations, university departments, and individuals) and in many foreign countries, kept me continuously in contact with the engineering practice. As an example, I was a consultant for several years to Kalium Chemicals for hydraulic solution mining of potash in Canada. That made me well aware of evolving professional problem areas, which need scientific research efforts. These activities helped me generate students under my ideas, both for PhD and M.S. thesis to graduate students under my advisor ship, for younger staff members, and for my personal research efforts. Both lecturing tours or short visits, and my broad areas of consulting worldwide, helped me to disseminate my developed concepts and methods of application of stochastic processes and mathematical statistics in hydrology and water resources development. I gave the full week course on stochastic hydrology in Montpelier, France. The first day I had about 20 participants in the lecture hall. Then word spread about the topics presented and discussed, with about 85 participants present on the fifth day of the lectures. After the last lecture, I overheard an older civil engineer (engineer of "ponts et chaussées") telling younger participants, that the lectures contained "important substance". I got similar reactions in Australia, in Sydney and Brisbane, with audiences of the interested hydraulic engineering practitioners. Similarly, I had many positive reactions on my lectures on the new scientific and technological developments in water resources in the United States in some other countries.

5.19 Activities in scientific and engineering societies or associations. My activities in engineering societies and scientific associations in the United States have been basically with the American Society of Civil Engineers, as its fellow, in America Geophysical Union (Section of Hydrology) and Sigma Xi. The international activities mostly covered the international Association for Hydraulic Research (by attending its 14 out of 18 biannual congresses), and serving twice as its vice president, with their honorary membership awarded to me at the Congress in New Dehli, February 1981. Furthermore, I was very active in the International
Association of Hydrological Sciences, the International Water Resources Association, and others. For longer periods of time, I served on the editorial boards of the three professional scientific journals (Journal of Hydrology, Water International and Stochastic Hydrology).

5.20 Research funding. My research in the U.S.A. was generously funded by several governmental agencies through grants and contracts, especially by the U.S. National Science Foundation. Other supports came from the U.S. National Institute of Health, Federal Highway Administration, the U.S. Bureau of Reclamation, the U.S. Weather Bureau, Office of Water Research and Technology, Colorado State Experiment Station, U.S. State Department and other. The continuous support for many years of my basic research in hydrology by the U.S. National Science Foundation helped me to create and maintain a dynamic graduate and research activity in hydrology and water resources at Colorado State University for two decades. It attracted excellent students and outstanding young staff members.

5.21 New water resources specialties. Some private consulting activities for U.S. corporations induced me to maintain a high level of hydraulic research of an applied nature. The United Nations mission in Lebanon in 1961, the United Nations Development Program missions in Turkey in 1978-1980, along with the U.S. Yugoslavian research cooperation on certified limestone hydrology and karst water resources in 1971-1980 periods, represented a kind of new specialties. They helped me to maintain an advanced knowledge and professional expertise in karst water resources in new areas. These problems and karst water resources often had very specific characteristics which required complex and relatively difficult investigations with innovating but reliable engineering solutions.

5.22 Work and interaction with students. Regardless of the very dynamic and versatile activities while I was associated with Colorado State University, I found the interactive research work with graduate students most stimulating. I always tried to induce them to benefit as much from their studies as their absorbing capacity would allow, making potential and environmental conditions at Colorado State University could offer or permit. My special emphasis was on making independent thinkers and researchers, as well as responsible people with professional rigor and integrity. It was not an easy or a pleasant task, especially asking non-adult and not mature young people, graduate students, to sweat for their own future good. My trust and the intuition to stress on future potential for the late blooming students, rather than blindly leaning too much on the past study scores, rarely failed me. My familiar approach was to personally interview the potential graduate students. Extensive lecturing and consulting travels and the attendance of professional meetings or business trips have been very useful in that regard.

5.23 Publishing activity. In 1971, faced with a declining publishing for fast outlet of proceedings and non-college books, my wife and myself started in 1971 a small publishing company, "Water Resources Publication" (WRP). At the time of finishing this autobiography, WRP is still publishing and selling books, but also computer software. The total number of books published and/or distributed by WRP covers about 400 titles. The distribution of books and software related to water resources to water resources, also published by the U.S. governmental agencies and some research institutes or companies, are included in this number of catalog titles. These titles cover a variety of topics on water resources, the connected earth sciences and the environmental water related subjects. As the number of sold books of high specialties rapidly decreased due to the copy machine and the change in information dissemination techniques, the maintenance of a small, very specialized outfit for publishing and distributing books, has not been a simple task. Publishing and/or distributing special software for various water resources disciplines has been shown very useful to readers. Having some responsibility in selecting manuscripts for publishing, and often the related computer software, permitted me to suggest to WRP to publish them. Books and related software of some excellent authors from European countries have also been published. Among them are books, monographs and software of several excellent authors from my native country, Yugoslavia, which have been published by WRP.
5.24 Retirement from Colorado State University. My full-time professional position at Colorado State University was terminated in August 1979. The termination resulted from the compulsory retirement of professors at the age of 65 years, as the Colorado State laws specified at that time. I continued to be associated with CSU on a part-time contractual basis (up to three months per year on contract, as the Colorado State regulations permitted without penalty in pension). That cooperation with CSU expired slowly in the post-retirement period of time, because of my association first with the George Washington University, Washington D.C. during the period 1979-1987, and then with my work on conferences (institutes and workshops) in the period 1987-1998 between the professionals of the NATO countries and those of the cooperating countries of Eastern Europe (mainly the ex-Warsaw Pact countries). It was done on a voluntary basis, with the objective to exchange experience between scientists of cooperating countries on several crucial subjects, including the water resources problems in rehabilitation and protection of the environment.

6. PERIOD FROM JOINING GEORGE WASHINGTON UNIVERSITY IN SEPTEMBER 1979 TO THIS UPDATING

6.1 Association with George Washington University (GWU). On September 16, 1979, I became associated with George Washington University, Washington D.C., School of Engineering and Applied Science, Department of Civil, Mechanical and Environmental Engineering, as research professor and director of a small Water Resources Institute of that School. The major emphasis of the Institute was on research activities. Keeping two residence apartments, one in Alexandria, Virginia, and the other in Fort Collins, Colorado, have made my dual duties of none versus three months appointments at the two Universities, much more stimulating than the case would be otherwise. The private universities in the U.S.A. need research contracts and grants, with their overheads, as the source of operating funds. So I found myself in the new system which I fitted well with my prior experience. However, diversity of sponsors of my type of research was not available in Washington D.C. as it was in the arid West. Eight years of mainly research helped me to continue producing results which were published in referee journals as well as in the proceedings books. In eight years association with GWU I taught only a couple of times the evening course on water resources systems.

6.2 General help from colleagues of the United States. This autobiography should not be properly terminated without the recognition of the help by my American colleagues. They were instrumental in my coming to the United States, helpful in my initial work for the U.S. National Bureau of Standards and the U.S. Geological Survey in Washington D.C. Many colleagues, professors, and administrators at Colorado State University made my adjustment to a new academic and research environment fully enjoyable and productive. The leaders of the School of Engineering and Applied Science at George Washington University, especially the Dean of the School, made my eight years in Washington D.C. research-wise very productive and enjoyable, both from theirs and my viewpoints.

6.3 Family adjustment to life in the U.S.A. and family guests. At becoming U.S. citizens, myself, my wife, and our three daughters had already been well-integrated into the community of a small university town in the U.S. West, namely in Fort Collins, Colorado, as well as in the American way of life. We have kept contacts with the two extended families either in Yugoslavia or in other countries. My niece Emilija Ckonjevic spent two years with us in Washington D.C. (1958-1960). My mother visited us for a year in 1959-1960. My younger niece, Branislava Ckonjevic, architect, spent two and a half years with us in Fort Collins, Colorado. My nephew Srijan Yevjevich, at the age of 15, spent a year with us in Fort Collins. The retired parents of my wife spent 15 months with us in Fort Collins. We enjoy many shorter visits by other relatives, friends and colleagues.

6.4 Activities of my wife. My wife Mirjana graduated from law school at the University of Zagreb, Croatia. After we married and had children, she left her job and selected to be busy with raising
three daughters, maintaining house (or apartment or both of the two residences, at Fort Collins and Alexandria), and helping WRP within her available time. She generously helps our daughters to raise our grandchildren. From one of our daughters she got a small pillow with a fitting inscription: "God couldn't be everywhere so He invented Grandmothers". From time to time, she also takes care of various family affairs. My versatile professional activities could not have been as feasible as they have been without the understanding and help of my wife. Both of us helped out families on both sides of our marriage, especially during the civil wars and post-war upheavals in Yugoslavia. When somebody asked me what was the best accomplishment of mine and my wife's lives, I do not hesitate to answer, "Our three daughters".

6.5 Present status of life of our three daughters. My eldest daughter Vera graduated in mathematics at the University of Colorado. She married Bruce Maytum, mechanical and computer engineer. They live in Orinda, California. At the updating of this autobiography in 1998, Vera was working as the senior vice-president of the Federal Home Loan Bank of San Francisco. My second daughter Branka, graduated in horticulture and landscaping at Colorado State University. She married Neil McLaughlin, a high-school teacher. They have two children, Kevan and Katie, at this time 16 and 6 years of age. Branka is the major owner and manager of Water Resources Publications, a small family publishing partnership. They live in Littleton, Colorado. The youngest daughter Rada graduated in accounting at the University of Colorado. She married Kent Brooks, industrial engineer and M.B.A., with both degrees obtained from Stanford University. During her three years stay with her husband in England, Rada obtained a M.B.A. degree from the London School of Economics. During her recent stay with a family in Tokyo, Japan she taught the course "Financial Statement Analysis" at the International University of Japan. At present she teaches a course in financial accounting at the University of California at Berkeley. Kent worked as a partner with Andersen Consulting. At present he is a free-lance consultant. They live in San Francisco. They have two children, Michael and Elizabeth. At the time of the updating of this part of the autobiography, they are 9 and 6 years of age, respectively.

6.6 Self-accounting of professional activities. I have kept a close account of working hours on various activities, both in Yugoslavia in the period 1944-1958, and in the United States in the period 1958-1996. It is my working history of the life and of my professional activities. The number of working hours ranged between 3,300-4,000 per year. Without keeping that account, I would likely have fallen into the following traps; (1) I would consider my very active professional life as a slavery to work rather than a pleasant creative activity; (2) I would likely have lost the direction in my work and other activities, if I did not have December 31 and January 1 each year to reassess my emphasis for the coming year, with these reassessments based on accounting of work in previous years; (3) I would not follow my deep appreciation, as the high school boy, for Benjamin Franklin's maxim that "time is money" (in the sense of productive creativity and the value for whichever activity one selects to undertake in life). That meant to me that I did not waste half of a century of my available time.

6.7 What to do with surplus of research ideas in water resources of an engineer/scientist in the advanced age. When one looks at the ways how research ideas are conceived, generated and formed, most often they will depend on age, both in generating and in implementing those ideas. Young scientists usually generate a small number of outstanding research ideas. Most often that is less than the available time would permit them to pursue. For the old age scientists and engineers, the situation and the process are reversed. Senior scientists usually have a lot of good health limitations in advanced age. They represent limiting factors of how much individuals may implement their research ideas. It is then the ideal time during the retirement years for the senior scientists and engineers to pass their visions to younger generation, with the potential benefits of projected research needs and subjects.

6.8 The 1996 Anaheim Conference of American Society of Civil Engineers (ASCE). At that conference I outlined the potential future research topics and explained why the specific research ideas and topics should be investigated. That was my rationale of investing time during my retirement years on the research needs in water resources development, conservation, control
and protection. The desire to disseminate the likely future research topics inspired me to work professionally as long as the natural forces and processes of aging permit. At the reception of awards given to me by the American Society of Civil Engineers in 1996, at the ASCE conference held in Anaheim, California, the award was for my contribution in establishing and advancing the stochastic hydrology. My acceptance speech, in connection with that award was on ideas likely to be future research topics in hydrology and water resources.

6.9 Collaboration with the NATO Scientific Affairs Division during 1987-1996. After the collapse of the U.S.S.R., and some other dictatorial regimes of countries of Europe, the North Atlantic Treaty Organization (N.A.T.O.) decided for its non-military Scientific and Environmental Affairs Division, to start the collaboration with the East European countries, and countries which were communist in Europe prior to the collapse of the U.S.S.R. I have cooperated with that division of NATO in organizing several institutions and workshops in water resources and in protection of the environment. The cooperation covered three such conferences (institutes and workshops) in Italy, three in Hungary, two in Greece, one in Bulgaria, two in Russia, one in Spain, and one in the U.S.A. That cooperation meant that I have written and delivered at least two lectures at each institute and/or workshop, and in such contents and forms that lectures represented the present state of knowledge on the selected subjects and topics of lectures.

6.10 Role as organizer if the NATO institutes and workshops. I was the senior director/organizer for several of these institutes and workshops. It meant, jointly with the co-directors from the host country, to select and propose the subject of the institute or workshop to NATO Scientific Affairs Division, to select lecturers, to invite and select participants of these kinds of conferences. When approved, the final selection of lecturers, advertising for participants, and the selection of their number and distribution among countries, is done as approved by NATO in the accepted proposal. Then, a meeting is held, lectures edited and proceedings prepared and published. The grant from NATO is also expected to be increased by the host country contributions in which the institute or workshop is held. As I had already the retirement pension and income from other sources, my work during these ten years of involvement with this kind of cooperation with NATO was voluntary, except for the travel cost, local expenses and other out-of-pocket expenditures that were covered by the NATO or host country funds. I have been very pleased of how well all phases of these activities were conducted. My available working time in that period (1987-1996) has been divided among the professional activities at CSU and with NATO.

6.11 Writing of a general, non-professional book. All my life was overwhelmingly devoted to professional and scientific work. However, I had excellent opportunities to live under different political systems and regimes. As the previous text demonstrates, I grew up under the semi-democratic monarchy regime of the Kingdom of Serbs, Croats and Slovenses between two world wars (often called First Yugoslavia), until the Second World War came to Yugoslavia in 1941. After that War, I lived for 14 years in the "Second Yugoslavia", this time under its dictatorial communist regime. Coming to the United States of America in 1958, becoming a citizen and living and working more than 40 years in the U.S.A., gave me insight on how the large democratic country works. Travels all over the World and visiting nearly all the European countries, starting at age 24, gave me insights in how the regimes of those countries worked. In the 1990's, I started to write a book on the future of America as a pleasant hobby. I expect it will be finished and published in the near future.

7. CLOSING STATEMENTS

7.1 Experience with various types of human institutions. Organization of the first human large societies, assumed to be greater than the extended families, needed discipline to function. They likely started 25-50 thousands of years ago. From those attained levels the societies advanced or declined, with continuous changes. I had privilege to observe societies of all sizes and types, from the most primitive to the most advanced. This hobby interest in human beings and their
interactions with nature as well as with the animal world was a strong source for me to mitigate my relatively narrow and highly specialized professional life. As my hobbies I became interested in global subjects, usually outside of my professional interests and activities. I found that good and interesting hobbies are needed for a successful professional life.

7.2 After 60 years of dynamic professional life, how should it be terminated? It can be assumed that my engineering profession started at my graduation from the University in 1936. Assuming further that the year 1996 is selected to be an artificial end of my engineering career, when I received the award from ASCE for my life accomplishments. Thus my career of an engineer and scientist was spread over 60 years as an engineer of hydraulics and a scientist of hydrology. My only wish in writing this autobiography in details has been that some bright young engineers or scientists have read this personal life description of a colleague-predecessor. I wish them to find worthy of standing on my shoulders for information on their water related discipline of interest, similarly as I have found it beneficial to stand on the shoulders of predecessors in my professional accomplishments. To answer this basic question put in this paragraph, the best way may be to write a professional autobiography such as this one.
PART I

FAMILY PHOTOS
PHOTO 1 PROTOVEREY MIHAIOLOJEVDJEVIC, Priest of the Parish of Golesha, Priboj, Serbia, FATHER OF VUJICA YEJJEVICH.
PHOTO 2 DARINKA JOVANOVIC-JEVDJEVIC, Daughter of Simo Jovanovic, hardware store merchant in Visegrad, BH, a family of four sons and four daughters, MOTHER OF VUJICA YEVTJEVICH
PHOTO 3  VUKOLA JEVĐJEVIĆ, the first priest in the Family Jevdjevic, GRANDFATHER of VUJICA YEVJEVICH
PHOTO 4  Children of Mihailo and Darinka Jevdjevic standing from left to right, son Vujica and daughter Zorka (Zorica); seating son Aleksandar (passed away at age of six).
PHOTO 5

VUJICA YEVJEVICH, student of the first year of Civil Engineering Department of the University of Belgrade, Serbia. He is borne 12 October 1913. Photo is from the month of April 1932. He graduated in October 1936 as civil engineer.
PHOTO 6   Middle age photo of Dr. Vujica Yevjevich
PHOTO 7  Dr. Vujica Yevjevich with your family
PHOTO 8  Dr. Vujica Yevjevich (center) with his four grandchildren from left to right: Elisabeth, Kevin, Michael and Kathleen
PHOTO 9  Dr. Vujica Yevjevich on ninety birthday
AUTOBIOGRAPHY
OF
DR. VUJICA YEVJEVICH

PART II

Social problems encountered in Engineering:

Observations and Experiences through the professional life of a Water Resources Engineer, a renowned International Lecturer, Consultant, Researcher, and Professor.

Highlands Ranch, Colorado, USA
2005
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<td>Research professor at George Washington University, Washington, D.C.</td>
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<td>Consultant, Writer, Publisher, Researcher, and Organizer of International meetings</td>
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SECTION II-A

FAMILI COMMUNITY ENVIRONMENT AND PRIMATY SCHOOLING

Section II-A-1. October 1913-1941: The Early Years in Priboj, Sarajevo, Belgrade and Skoplje

II-A-1.1 The community Priboj, where Yevjevich was raised, had a population of approximately 1,000 people at that time. The small town was comprised of a segregated community of individuals who accepted the Muslim religion and individuals who accepted the Christian religion.

II-A-1.2 His Father was the priest of the Serbian Orthodox-Christian parish. Many of the Christians considered themselves as peasants. Economically, they were modest people. However, many of the surrounding villages had Muslim population. For 600 years the Muslim religious community had been the power of Serbia and the Christians had been placed as the minority. Considering, Yevjevich had to be aware of the religious and political controversies in the community.

II-A-1.3 The ancestors of the majority of the Muslims had been Serbs, Croats, Slovenians, Bulgarians, or Macedonians, who had accepted the Muslim religion for simple reasons of receiving benefits, both economic and political, from the Turkish Empire.

II-A-1.4 As a young boy, he refused to get involved in any controversy of any kind. Both religious communities spoke the same language and shared the same customs. The only difference was religious background.

Section II-A-2. Life in Sarajevo as a High School Student after finished the primary school in Priboj in 1944

II-A-2.1 In the student dormitories provided by the Serbian education and cultural organization called "Prosveta", Yevjevich spent eight years studying in high school and was involved with Serbian youth organizations. As it is mentioned earlier, he was raised in a segregated community, although, strange enough, he did experience some culture shock while studying in the high school. The school population was broken down so, as the largest of the population were Muslim. The second largest population was the Serbs, then the Croatian population, and lastly the Jewish population.
II-A-2.2 As a Serb it was easy for him to associate with the Jewish students, however it was difficult to associate with some Muslim religious bigots as well as some Catholic Croats. About a fourth of the students always raised issues and made some kind of controversy. They would gather in the café and were politically incorrect in implying that Sarajevo was “owned” by the Tel-Aviv. Remember of Jewish student challenging them by telling them to go to the “Katastar” were the real estate is registered and there they would see who’s Sarajevo it is the city one live.

II-A-2.3 Living under the structures of the different customs, religions, rules, and habits was very difficult. It was not his personality to be involved in this type of controversy and avoided it at all times. After all, he had good friends who were Muslim, Croatian, Serb, and Jewish. Even until this day his family has many friends from different religions and aspects of life.

II-A-2.4 Yevjevich’s best friend in high school was a Jewish fellow named David Finci. Sadly, he was killed in the Partisan War. The Finci family was always generous to him. Finci asked in support, as his friend that Yevjevich buy clothes or shoes from his fathers’ shop in Sarajevo. He told Yevjevich, “Go on Monday morning and be the first customer at my Fathers’ shop. If he asks you if you need shoes and offers you a price, then offer him half the price and he will not refuse you. He never refuses the first customer.” Yevjevich laughed and went to the shop just to see if Finci was right or not. Of course, he was right.

II-A-2.5 In Sarajevo Yevjevich was a very modest student and was very much focused on studying. He was the best student in the first high school in Sarajevo. He held the highest grades in all his areas of study. He never had an error on his examinations in mathematics. He was the best role model for the other boys in Sarajevo. He was very much involved in soccer and participated in some gymnastics.

II-A-2.6 During his studies, Yevjevich had befriended his mathematics professor Mr. Stjepan Tomic who gave him a very good book on problem solving in algebra. A handful of times he had difficulty solving mathematics problems. He would work on the problems all day, but he couldn’t solve them. When he would go to bed at night then suddenly he would understand a connection to the problem. He would wake up, gather his books off of his nightstand, and he would solve the problem. The mathematics problem-solving book that Mr. Tomic gave him was very helpful. He had never seen such a large collection of problem solving exercises in one book in the entire world.

Section II-A-3. Making decision to go to college to study

II-A-3.1 Yevjevich had always been inclined to study theoretical physics. At the same time he was interested in radioactivity. He was pursuing a fellowship to work under Madame Kiri, the Polish woman who discovered radioactivity, but his Father and his high school professor of German and Latin did not believe that theoretical physics was the best degree to obtain for him. His Father wanted him to study engineering or some other
practical occupation so that Yevjevich could have a decent material life. The Professor agreed with his father.

II-A-3.2 Yevjevich professor's observations, he felt that if he merely studied theoretical physics, that his destiny was to be a high school professor in Serbia or Bosnia, but nothing else, because with a job in theoretical physics there was not much opportunity for advancement in the industry. His professor continued to inform him that if he studied engineering that he could either work in the sciences or in the business.

II-A-3.3 Professor pursued to share a story with him about two brothers. One brother studied many languages including Latin and Greek. He had a great education, however when he received his degree he went on to be a high school professor. He made income to barely pay his living expenses. The other brother studied eight years of school for ten years because he repeated two classes. He studied pharmacology. He was very successful and his income was so great that he was monetarily capable to help his brother, the high school professor.

II-A-3.4 All this information helped Yevjevich in making him decision to study engineering, but he made a compromise. Yevjevich enjoyed water very much. He thoroughly appreciated water sports such as fishing, boating, and swimming. His compromise was to study Hydraulic Engineering.

II-A-3.5 Yevjevich enrolled at the University of Belgrade (Civil Engineering Faculty). He graduated, with a high distinction in four years, with his degree as a Civil Engineer from the University of Belgrade, with an emphasis in Hydraulic Engineering. He never regrets studying engineering, because he was able to work in the sciences of engineering and in the practical engineering.

II-A-3.6 When he went to Belgrade in 1932 he shared a dormitory of 500 students. The University campus was conveniently located to the dorm to make his classes and activities easily attainable. While being a student he ensured that he studied often. He studied most of the week, but Saturday and Sunday evenings he would gather with friends for some kind of entertainment. They would listen to music in the cafés, attend soccer games, and were involved in other forms of recreation.

II-A-3.7 He worked very hard to achieve his goals. He started college in 1932. During his first year of college he brought his grades home to share his accomplishments with his parents. Yevjevich was very proud and excited because he had high grades. The reaction that he received from his Father was not exactly what he expected. When he gave to his Father his grades, Father said, "That is good for you. If that is what you are doing then it is very good for you, but it is your problem". He made him feel like he was not interested in what his son was doing with his life any longer. From that very day on he decided not to involve his parents in his decision-making concerning his future.

II - 3
Section II-A-4. Political Orientation

II-A-4.1 In student life, politics and political parties were abundant in the new orientation of Yugoslavia, the kingdom of the Serbs, Croats, and Slovenes. It was interesting how the younger democracy of Serbian origin was on the rise and how many different political parties were being created.

II-A-4.2 For him, in selecting a political party, he based his membership to an organization on pure sentimental experience. There were many options to be had, especially when the agenda was politically motivated. The parties available were the extreme parties: Nationalists, Radicals, Democratic, Peasant party, Socialists, and Communist party (though illegal according to the government).

II-A-4.3 His Father was priest of a parish where relatively poor peasants congregated. As a student, Yevjevich felt it was his duty to join the Peasant Party in Serbia. His father was paying for him to study in Belgrade. That income was coming directly from the peasant population of the church. Yevjevc decided long ago, in order to give back to the community, that he would join the Peasant Party when he was of age.

II-A-4.4 The party was fighting for 80 percent of the peasant population. Peasants had relatively been exploited since the earlier days of Yugoslavia’s small democracy. The peasants had meager land, especially the Christians in comparison to the Muslims. It was also hard for these people to obtain their land.

II-A-4.5 His Father contributed to this issue by creating small loan cooperatives and companies to help the people acquire affordable rates of interest. The wealthier citizens in the community felt conflict with the small loan companies because the well-to-do families lived off of the very high interest rates of 15-20% a year from the loans to the peasants.

II-A-4.6 Father was also active in the cause by sending approximately 50 young boys, from his parish, to Northern Yugoslavia about every year so they could learn different artisanship such as tailoring and blacksmith ship. Approximately half of the boys would go back to south Serbia and the other half would immigrate to Voyvodina to north Serbia.

Section II-A-5. Reserve Officers School in October of 1936

II-A-5.1 It was normal practice for students to be assigned to Reserve Officers Schools in this regular military service in Yugoslavia. He was sent to the School of Reserve Engineering Officers in Maribor. In June of 1967, he was released from Military school with a diploma of Reserve Engineering Officer. Later when the war started in 1941 he was deemed Reserve Lieutenant.

II-A-5.2 This was a very useful decision to attend the Officers School, but he will be explaining more on this topic later when he discusses prison camps. Although, being a
reserve officer and being captured by the Germans made him focus on his life problem and he made very good use of his time. During his prison-camp time it was the most efficient time of his life.

Section II-A-6. In Belgrade in summer of 1937

II-A-6.1 Time from June to November of 1937, Yevjevich focused on two goals. First of all, he worked with his professors by helping them as a supervising engineer. He also worked as an assistant to professors by investigating conflicts that had come about in some of the structures designed by professors. Through his odd-type works he was able to earn enough money to live in Belgrade during the summer for six months in 1937.

II-A-6.2 The other aspect of his goals was to network with the other engineers in the community. Through that networking he met the Administration engineers of the Ministry of Public Works in Belgrade. It was a great experience for him to have the acquaintance of an experienced hydraulic engineer. He had invited Yevjevich to discuss different techniques in regulating river channels in Europe, especially to discuss the French and German concepts of regulating rivers. The French let the rivers regulate themselves. The German concept of constructing fixed walls on both sides of the river channel, another concept such as done for the Danube River along the Pannonian Plain. He was asked to look into this matter. He researched these techniques as thoroughly as feasible. He read everything that he could find in the library at the University of Belgrade. He also did research at the Administration of the Ministry of Public Works on river channel regulation systems.

II-A-6.3 Yevjevich's findings indicated that the concept of regulating river channels resulted mostly from the deterministic factors on how the river flows, in particularly without any random component. The other approach was rare, namely to consider characteristics of the river channel as random variables, especially including the radius of the meanders and the length of the meanders as well as any other characteristic of the channel.

II-A-6.4 By compiling the summaries of relevant literature that he had gathered, he found randomness to be a basic neglected component of regulating river channels that should be taken into account. He shared this view with all the other engineers of the Ministry. They liked his ideas and concluded by informing him that they had an intention to fill positions for young hydraulic engineers in three cities: Novi Sad in Voyvodina, Split in Dalmatia, and Skopje in Macedonia. They told Yevjevich if he went to Skopje that he would be funded not only to design regulation channels of the Vardar River through the city of Skopje and along the Plain of Skopje, but also to do general research on regulation of river channels. He selected the city of Skopje as his next job.
Section II-A-7. Life and work in Serbia, Macedonia

II-A-7.1 He went to Skopje to start the job on December 1, 1937. He felt he was in a very professional environment taking into account that the hydraulic engineers were extremely knowledgeable of modern technology in water resources engineering. The technical administration department was responsible for making contracts with the contractors and also controlled the execution of the contracts. He was extremely happy about his decision of accepting the job knowing that Novi Sad and Split have attracted the best young engineer.

II-A-7.2 One hurdle that he faced was that he was the youngest engineer in the department and the experienced engineers called him “the child.” In case of difficult hydraulic problems the other engineers would say, “Let the small child take on this difficult problem.” The following is an example of such problems. It was predicted that the Vardar River was going to flood airport. The river flooded the Skopje airport in for weeks. The Chief of the engineers asked him to research why the Vardar River continued to flood. He looked into the problem and realized that the Vardar River was entering the airport in such a way by transforming kinetic energy into potential energy. That resulted in a higher level of the river at the airport for about half a meter. He concluded that this is what kept the airport flooding, and suggested that the entrance to the airport should not be rising on the water level. When he explained his conclusions to the Chief everyone else was interested as well. The Chief wanted someone in Belgrade to confirm this solution. The office later received the word that his explanation was correct. He became the only hydraulic engineer to whom all such hydraulic engineering problems were assigned.

II-A-7.3 Until October 1938 Yevjevich worked as an engineer has been on small projects. He had invented an efficient and time effective system of getting a supply of water to villages. He would start a project by finding the closest source of water available. It was usually a spring. The spring would be one to three kilometers of maximum distance from the village.

II-A-7.4 He would proceed by contacting the engaged contractors. They would bring the pipes and other supplies needed for the water supply project. Then, on the field, the infrastructure for the spring would be worked out, followed by the farmers digging the ditch for the pipe and laying the pipe. After the pipe was laid, then the project would usually be completed in three to four days.

II-A-7.5 At the center of the village a fountain would usually be erected as a symbol of the work completed. Water would flow continuously from the spring. When visiting the villages he would receive gifts of appreciation, especially from girls who had been carrying water for a few kilometers prior to the completion of the project. With the project completed, then the water was close to their homes.

II-A-7.6 The other small project he worked on was a drainage project of small swamps, small irrigation projects and small hydropower plants.
II-A-7.7 In order to be successful in this industry one needed all the practical experience that one could obtain. For example, he started blasting the rocks in tunnel. He felt that this type of experience was important to have, so that one could experience how hard workers of the special projects must work to complete a job safely, concisely and correctly in a timely fashion.

Section II-A-8. Political Situation in Macedonia

II-A-8.1 Yevjevich learned from the Macedonian colleagues that it is very sensitive to get involved into the controversial political subjects of Macedonia. At that time, the Macedonian future had three potential solutions, Serbian as the South Serbia of the time 1918-1941, as the Western Bulgaria and the independent Slavic nation independent of Serbia and Bulgaria. At that time, it was early to speak of the political environment, but in Macedonia there had been a pre-orientation concern regarding the Macedonian future. One aspect was the Serbian the Macedonia South Serbia, the other Bulgarian pretense that Macedonians were western Bulgarians, and the third one was a Slavic Nation independent of Serbia and Bulgaria. He avoided controversies, though he had friends who had been supporting Macedonian nationality, and those who had been for the Bulgarian nationality, and lastly those who had been in support of the Serbian nationality of Macedonian.

II-A-8.2 A large Muslim community of Albanian nationality existed in Macedonia (25% of the population). Yevjevich had worked on projects in both villages, Christian and Muslim. One of the projects he worked on was draining out the Mavrovo Plain in the high mountains in order to increase the production of food for the animals. Later, when he started design of large systems of power plants in Yugoslavia, he based his project ideas on the similar concepts that he had used earlier in design of small project.


II-A-9.1 The engineers from the Minister of Public Works in Belgrade called Yevjevich one night by telephone and informed him that the French Government was giving a fellowship for a hydraulic engineer from Serbia. The fellowship included a postgraduate study in France for a year. He applied and was immediately granted the fellowship. He went to France in October of 1938 for a year. He took a leave of absence, without pay, for a year from his job in Skopje. In Paris, he visited the famous school of Highways and Bridges. It was famous for teaching mathematical background of the first class. When Yevjevich met with the professor of the school, he was asked what he would like to accomplish in engineering in his life. Yevjevich told the professor that he would like to apply practical as well as use the theoretical engineering in his career. The professor suggested that he goes to the city of Grenoble in France to the School of Hydraulic Engineering. The professor explained to Yevjevich that he could obtain a hydraulic engineering degree in one year, what he couldn't do that in one year in Paris. Yevjevich
accepted the advice, went to Grenoble, and enroll into the school. The majority of students were French except for a Chinese student and Yevjevich. School was in a comfortable educational environment, because it belonged to the University of Grenoble. Yevjevichs’ background and level of education was practically equal in comparison to that of the French students. This included knowledge of mathematics, physics, and other branches of the sciences in engineering. At the same time, it was very different, but interesting situation. The foreign students were not judged the professors, but they did by the French students. The Professor would openly ask, “What do you think about Vujica?” and the French students would respond by saying, “He is equal to us, if not better.”

II-A-9.2 So, Yevjevich studied experimental aspects of hydraulics, both in nature and in hydraulic laboratory especial that of the private firm Neyrpic under the guidance of Professor Pierre Dannel. He knew that one day in Yugoslavia there would be a program of hydraulic engineering and there would be a need for good laboratories.

II-A-9.3 Yevjevich decided to study hydraulic laboratories in France and England. To get the practical basic experience in solution of complex water resources problems, he accepted a suggestion by Professor Dannel to study Algerian water resources problems, the seminar works. France was building the irrigation projects in Algeria to produce better food production; however, all rivers in Algeria carried too much sediment. So, the live of reservoirs were often very short, approximately 30-50 years. It was not feasible to establish an agricultural community with water available for irrigation only for such a short period of 30-50 years. Furthermore, canals carrying water from the rivers for irrigation would be filled with the sediment and their capacity decreased. This was one surprising experience for Yevjevich. He decided to study how to clean canals from the sediment deposits. The other problem was how to remove sediment from the reservoirs. This study had a full effect on him for life. These two studies produced a switch in Yevjevichs’ professional life. This switched the emphasis of his education from experimental hydraulics to practical hydrology in engineering and water resource development. The French students and the professor liked Yevjevich very much. They considered him professionally equal to themselves. Professor Dannel took Yevjevich to Paris from Grenoble when he graduated as a hydraulic engineer in 1939. In Paris he took him to the Patent office of France and showed him an interesting idea. Many historic ideas were such that they could not be applied because of missing materials and corresponding technology to apply the idea of the patent. However, new materials and technology were to available now implemented.

II-A-9.4 Neyrpic laboratory had produced hydraulic equipment, which were instruments for controlling the upper and lower levels of the canals as well as taking the prescribed volume of water into the irrigation field. That impressed Yevjevich as did the irrigation canal from the Indus Canal in India, with three historic technologies, dependent on three different materials and matters of solving the problems of the canals. The first tunnel was based on iron material and hydraulics of flow. The second tunnel was based on steel and control of the canal performance. The third tunnel was based on the computer technology and computational hydraulics.
Section II-A-10. Travel through France and England after Graduation

II-A-10.1 In June of 1939, Yevjevich traveled after graduated from the School of Hydraulic Engineering in France. He visited many hydraulic laboratories in cities such as Paris and Toulouse in France, Edinburgh, Birmingham and London in England. During these laboratory visits he had the opportunity to spend a couple weeks in the Laboratory for Mechanics of Soil and Rock, located in Paris. That experience was useful to him later in designing earth and rock fill dams in Yugoslavia.

II-A-10.2 He lived in England for two months visiting all the laboratories and other institutions that he had access to. He studied hydraulic problems, which could be experimentally solved, especially those connected to research; project problems, and many other practical problems studied in hydraulics were studied in several hydraulic laboratories in England.

II-A-10.3 Yevjevich was in England on the first of September 1939 visiting Trafalgar Square, when Mr. Chamberlain, the Prime Minister of England, declared for war on Germany. It was the beginning of the Second World War. News of the Germany’s attack on Poland traveled quickly. That same night Yevjevich left England by boat to France and then through Italy, fearing that he would not be able to return to Yugoslavia if he stayed longer in England and France. He finally returned safely to Macedonia by train.

Section II-11. New Job at the Time of War

II-11.1 When Yevjevich arrived in Skopje, he found that the Minister of Public Works in Belgrade had appointed him as the Chief of a special section which monitors river dnenal regulation aspects. Accepting this position it was necessary for to study and design the project of river channel regulation through the Skopje plain to study the new technology of river channel regulation. Being a young engineer and chief of a section was a wonderful opportunity. He worked hard and in return had a good salary.

II-11.2 When he started to work, taking the topographic data of river channels, the radius and the length of meanders came out to be random variables.

II-11.3 Then in March of 1941 he was mobilized to a military unit as a Reserve Engineering Officer. He was deemed commander of the unit for building pontoon bridges. We gathered in the Skopje Plain and did testing of the assembled bridges.

II-11.4 The War was progressing and Germany declared war on Yugoslavia. German and Italian forces attacked Yugoslavia. Then in the month of April Germans captured Yevjevich with his unit in the Skopje Plain, were transferred to Bulgaria, then to Germany and later to Italy.

To be continued
WATER RESOURCES ENGINEERING SERVICES
IN MORE THAN 60 COUNTRIES
BY DR. VUJICA YEVJEVICH
1937-2005

PRIMARILY BASED ON PROFESSOR YEVJEVICH'S RECOLLECTIONS

PART III

HIGHLANDS RANCH, COLORADO U.S.A 2005
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1. ALBANIA

SUBJECTS

1.1 Drim River along the two reservoirs

1.2 Vaudies Dam Site and hydroelectric power plant

1.3 Kukes Dam Site and hydroelectric power plant

1.4 Diversion from Ohrid Lake to the Adriatic Sea

1.5 Diversion of water from Prespa Lake to Ohrid Lake

1.6 Ulcinj Sand Deposits

1.7 Diversion of Prespa waters

1.8 For irrigation to Albania

III - 1
1.1. Rivers: Drim, White Drim and Black Drim.

The watershed of these three rivers belong to four countries: Albania, Greece, Macedonia and Serbia/Montenegro (if not marginally even to Bosnia/Herzegovina). The White Drim comes from the province of Kosovo, entering Albania from the North. The Black Drim comes from Southeast from Macedonia, entering Albania. They merge into the river Drim at the place Kukes.
At the beginning of 1945 Vujica Yevjevich* was assigned the duty to study, among Serbian water problems, also the other water resources schemes in Yugoslavia including the hydroelectrical system Mavrovo in Macedonia (on his proposal). It was approved, and his work immediately started. Mavrovo is in the Drim river basin. At that time the relations were good between Albania and Yugoslavia.

The studies of the River Drim by Yevjevich demonstrated to him that the major aspects of that river are water power and flood control. The first trip to Albania in a delegation of best engineers visited the various accessible places of river visiting the places likely to be the best to locate the future dams and HE plants. That was crucial for Albanian as well as Serbian engineers.

The delegation visited the Lower Drim in the vicinity of the city Skadar and the Lake Skadar. Yevjevich supported the idea of Albanian engineers to locate a dam of a hydraulic net hight 20-25 meters as the lowest level close to the sea. Yevjevich argued that soon or later the users of that power must develop it. That means the consequences of retention of sediments in new reservoirs must be faced. Hydropower and flood control, plus the solution to sediment problems, must be solved by the design engineers.
1.3. Location of Hydroelectric Power Plant

Kukes.

It has been obvious that it will be easy to prove, by the argument offered to Albanian engineers, that this plant belongs to the most attractive economically to be built soon. The general concept is given in the following figure. That scheme of "double reservoir" aspect has inspired Yevjevich to some theoretical connection between topography of "confluence of valleys".

Figure 1: "Double reservoir case"

A and B = two rivers converging
C = Resulting Valley

1.4. Water diversion and power production from the Ohrid Lake to the Adriatic Sea.

The British hydropower developers influenced the peace treaty after the First World War, in the benefit in borders of the Ohrid Lake to Albania, expecting the concession on the Lake hydropower.

Yevjevich as the engineer of technical authorities in Skopje, studied this aspect and found that this separate one small peace solution approach would make negative effects in the solutions of water resources problems of importance to three other countries in the Ohrid-Prespa-Drin River Watershed Region. It will be beneficial to discuss briefly a special approach in applied research, performed often by Yevjevich.

Figure 1 shows two large valleys, with meandering and worth utilizing river in each. Should only one dam be studied at the location of the river downstream of the confluence of the valleys, or two dams studied, one on each with independent reservoirs. Nearly all engineers would select only one dam first. Only if conditions are difficult (say very bad geology or too flat topography, or too much flooding of valuable property), one would not go to "double reservoir" first. Yevjevich has used some special measures for determination of topography preferences.
Preference in study should be derivation of water outside of the river channel (by using canals, tunnels, pipes for concentrating heads of HEPP (hydroelectric power plants). For slopes of the river less than 3.00%, first to study should be the dam site for HEPP. usa both approaches simultaneously.
1.6. EFFECTS OF SEDIMENT OF RIVER DRIM ON THE DYNAMIC CHANGE OF ADJACENT ASTAL ARPA

The sediment which the River Drim brings into the Adriatic Sea in the Skadar areas of Albania is continuously under influence of the Mediterranean Current which enters and runs along the circle in Adriatic Sea. It runs counterclockwise and returns along the west coast of Adriatic Sea into Mediterranean Sea. To move sediment from southeast to northwest, it must be lifted into suspension at least for a short moment so that the continuous current may at least for a short time move the solid particles along the coast. The predominant winds are approximately normal to the east coast of Adriatic, so that generated waves by winds break and thus attik the sediment at rest. The solid particles get it into suspension, giving the opportunity to current to continuously act incrementally and move the sediment in the direction of the current.

1.7. UTILIZATION OF WATERS OF OHRID AND PRESPA LAKES

The general attitude in Balkan countries is that the two largest Balkan lakes should be left in natural states. That attitude may be challenged. Yevjevich is of the opinion that the lakes may be kept in nearly natural states and at the same time use water for the most important consumption. Those are drinking water, most important supplies of industry, for peaking power and irrigation around the lakes by pumping water up to 50-75 meters.

An international concours may show that some solutions exist to keep both lakes environmentally in good state while at same time using water for the most necessary consumption and use.

1.8. EXCEPTIONS IN USING WATER OF LAKES FOR POOR AREAS AROUND THE LAKES

In study of utilization of waters of Ohrid and Prespa Lakes, Yevjevich insisted not to take any compromising positions. There been hard proves that some nonprosperous communities existed in the vicinity of the lakes in all three states: Albania, Greece and Macedonia. The only large natural resource is the abundant resource, the water of lakes. It is logical that some exceptions must be made.
2. Study of various approaches to evacuate deposited incoming sediment into the reservoirs.

2.3. Often, in arid regions of the World, the politicians decide to create new settlements. As they each need water, practically for all functions from drinking it to irrigation. A controversy easily occurs. Overuse of land through not only hundreds of years, but often thousands of years. The erosion has been very destructive by a large sediment of rivers. Reservoirs become rapidly filled by these materials. Some filled in the span of less than half a human life. When there is no more "cheap water" around the corner, the collarory starts dissipating, de facto, sign of their demise. Public money may come to rescue by usually professor and direct firm Neypic in Grenoble, France. asked *

Reference: Serb Yevjevitch, interested for his entire life. The reason for putting that topic under the country Algeria seem to be a contract given Neypic to look the problems in that country by the French Government.
Algeria is one of three North African countries with a Moslem population of 99%. Most of the Moslem world is located in arid lands. The problems associated with such regions are difficult to overcome. Yugoslav geologists, hydro-geologists, hydraulic engineers and other specialists have been very successful in helping their colleagues in this area with solving water resources-related problems.
2.5. PROBLEMS AND SOLUTIONS OF SEDIMENTS OF RIVERS AND OF IRRIGATION OF NORTH AFRICA LANDS

In October 1938 it was feasible to enrol into one year School for hydraulic engineers in Grenoble, France. The precondition was to have already a degree of civil, agricultural, environmental or similar engineering. The degree of hydraulic engineer was approximately to have already a diploma. The degree of Grenoble engineer was approximately equivalent to American M.S. degree in engineering. Instead of enrol in Ecole des Ponts et Chaussees in Paris, Yevjevich, is persuaded by official French advisers in Paris to become the student of Grenoble School for Hydraulic Engineers. He never regretted accepting that advice.

Couple of weeks after Yevjevich started the School in Grenoble in October 1938, he was invited by Mr. Pierre Daniel, professor of hydraulics and director of Nenrtic Hydraulic Laboratory. Yevjевич was informed that he will have during the two semesters: the two seminar works: cleaning the conveyance structures and studying the risks of the modern irrigation civilization on arid lands of North Africa.

2.6. SCHOOL OF HYDRAULICS AND YEVJEVICHES FUTURE PROFESSIONAL ACTIVITIES.

As the result of the water resources research policy of School professors, Yevjevich became oriented by professional interests to river sediments and channels, and irrigation of large and regions (specially in massive middle and small projects in French colonies). (1) Sediment problems in rivers included erosion, its transport by rivers and canals, including final deposition and/or benefits; (2) Regulation of natural river channels, whether by using deterministic, stochastic, or deterministic/stochastic concepts of design; and (3) in developing the modern concepts of irrigation in arid regions of the world, Yevjevich conceived the discipline of water resources economics. That scheme was supposed to include field investigation, planning, development and operation of complex water resources systems, as presented in the first world book written by Yevjevich with the title in Serbian language "Vodoprivredna Osnowa" (or Water Resources Scheme * in English), Novi Sad, Yugoslavia, 77 small size pages, published only in Serbian language, in 1949.

2.7. IT WOULD NOT BE SO EASY TO ESTIMATE HOW MUCH TIME WILL TAKE AND HOW COSTLY WILL BE THE RECOVERY OF ORIGINAL PRODUCTIVITY OF THE NORTH AFRICAN SOILS.

It is not a simple task to estimate how much the Arab countries of North Africa, and similarly of the Middle East, have lost of the original productivity of their soil. Even more will be complicated and unreliable if the task would be to estimate how long and how will last that recovery.

Let us assume that Italian scientists have come with the two expected figures, namely what would be the necessary time on working on recovering the original productivity of the soils of the Appenine Peninsula lands: NECESSARY TIME AND UNAVOIDABLE COST, say time would be 250 years (10 % of the time during which the soils are degraded at the present state). The cost is estimated to 25 trillion of the present value of U.S. Dollar, or about one billion Present American Dollars per year, on the average.

How many contrary estimates will appear, and how many politicians would try to take advantage of public appearance which the biggest public issue in the history of cultural life on the Appenine Peninsula offers?. This case was an example that each important water resources project soon or later evolves into a particular political issue. Therefore, it is best to always make distinction between water resources and engineering aspects and the political aspects of every human activity, coming forward on the scene, soon or later.

2.8. LIFE OF RESERVOIRS DUE TO SPECIALLY LARGE QUANTITY OF SEDIMENTS BEING RETAINED IN THE RESERVOIRS IN ARID AND DESERTIC REGIONS OF THE WORLD.

The experience in the Grenoble Hydraulic Engineering School showed Yevjevich the following results in sediment/reservoir relationship:

1. One may pass through reservoir only easy if 80-90 % of sediment of very fine silt which forms density currents along the shoreline.

2. Upstream sediment deposits of coarse grains during low inflows can be moved by large inflows provided the intention is to move the sediment from useful space to dead space.
The cooperation between Argentina and the United States in science and education was relatively limited during the period of time in the 20th century in which the USA de facto dominated the world. As a consequence, of all Spanish-speaking countries of the American continent, the least percentage of graduate students went to USA. Many U.S. universities neglected this remnant of the past Spanish-USA controversies, opting to cover the largest areas of the Americas.
Participation of Prof. Yevjevich in professional cooperation between him and professionals of Argentina and Uruguay.
This cooperation may be defined in five topics:

3.1) Rainfall/Runoff relationship in small watersheds in agricultural areas in Argentina. This was done in the form of a course delivered by a group of Colorado State University (CSU) professors, including Prof. Yevjevich.
3.2) A Rainfall/Runoff relationship course on agricultural small watersheds organized by CSU professors, with Yevjevich participating. It was held in Montevideo, Uruguay.
3.3) Lectures in stochastic processes in hydraulics and hydrology to faculty members at the University and other professionals of Buenos Aires.
3.4) Visit to Pampas and discussions with Argentinian colleagues on water resources problems and solutions.
3.5) Discussions on the methods of computing floods of the Parana River for the construction of hydro power plants.

3.1) RAINFALL/RUNOFF RELATIONSHIP IN SMALL WATERSHEDS IN ARGENTINA. When the use of advanced hydrology in water resources projects increased worldwide, many requests came from different parts of the world to CSU for professional hydrology aid. Yevjevich was instrumental in organizing a couple of presentations, among others, one course on advanced hydrology in Argentina and another in Uruguay. The course in Buenos Aires was on general response of river basins to rainfall input. The Argentinian organizers asked Yevjevich to look into those methods of rainfall/runoff relationship which can be applied massively in the large Pampas area. The important factor was the participation of Argentinian hydro-meteorologists.

3.2) RAINFALL/RUNOFF COURSE ON AGRICULTURAL SMALL WATERSHEDS IN MONTEVERDE. When the CSU team of lecturers was invited by the research group on small watersheds in Uruguay, it was emphasized that they were mainly interested in rainfall/runoff relationships in agricultural watersheds. On the proposal of Yevjevich both methods, deterministic and stochastic, were included in the lectures prepared specially for the Montevideo course. This was likely the first course on small watersheds held by the CSU staff abroad. The visit to experimental areas in Uruguay helped make a bridge between observational data and theoretical responses of river basins.

3.3) LECTURES IN STOCHASTIC HYDRAULICS AND HYDROLOGICAL STOCHASTIC PROCESSES. During Yevjevich’s visit to Argentina on international conferences on hydraulics and hydrology, he was often asked to deliver lectures either in stochastic hydraulics, which was new to younger staff members at the university, or hydrological stochastic processes. Mostly the material was very new in hydrological research.

3.4) VISIT TO PAMPAS BY PARTICIPANTS OF THE HYDROLOGY COURSE. Yevjevich proposed that the tour of Pampas, from a touristic point of view, be supplemented with a visit to the terrain and a discussion with Argentinian professionals of the water resources problems and solutions. It was accepted and productive discussions were held during a picnic, especially a discussion on the comparison of water resources problems and solutions in other arid areas of the world.

3.5) FLOODS OF THE RIVER PARANA. In planning hydro-development of the river Parana, the problem of how to determine the corresponding highest floods was often raised, not only among the engaged professionals, but also during international meetings. As Yevjevich had been involved in the development of flood computations with the US Corps of Engineers, it is natural that some of the Argentinian colleagues asked for an explanation on the method of how to tackle the risk of flood from the point of view of random processes of floods.

In summary, Yevjevich’s contribution in Argentina and Uruguay was marginal but basically on problems which had also been studied by other world engineers and scientists.
CONTENTS: (1) Lectures by Yevjevich on stochastic processes in hydrology at Kensington University; (2) Visits to the surroundings of Sydney, and discussing local water problems; (3) Active participation on stochastic hydrology at Canberra Water Resources Congress; (4) Visits to Melbourne and review of water resources problems and solutions; (5) Consulting on water resources problems at several locations with staff members of state hydraulic engineers and delivering a course on stochastic processes; (6) Review of the report on water quality of Saint Mary's River; (7) Looking on salt problems south of Adelaide from the point of view of Yevjevich's experience with salt in Yugoslavia; (8) Round table discussions on water problems with university staff members at the University of Perth; (9) Study of tracts creating ground water aquifer in bedale formation near Perth; (10) Investigating reservoir water quality as it changes during the year; (11) Delivering a course in stochastic processes in water areas in Newcastle, with emphasis on hydraulic stochasticity; (12) Holding a special practical course for engineers on application of advanced probability theories and stochastic processes in Brisbane; (13) Visiting a study of ground water permeability in the neighborhood of Brisbane; (14) Serving as member of a Ph.D committee in hydrology at the New Guinea University.
4.1 COURSE ON STOCHASTICITY IN WATER AREA AT KENSINGTON UNIVERSITY, NEW SOUTH WALES. Professor Monroe of the University of Kensington invited prof. Yevjevich to deliver a full course on the application of advanced stochastic processes in hydrology and water resources area. Prof. Laurashone of the University of Kensington was accepted on sabbatical leave at Colorado State University. For a year he was associated with the hydrology and water resources research and graduate program at the civil engineering department. At approximately the same time prof. Monroe invited prof. Yevjevich to deliver a course on particular aspects of stochastic processes to water resources. With these two events the cooperation between prof. Yevjevich and Australian institutions on the application of modern water resources area started. Leaving Australia, prof. Yevjevich had only visited the Kensington area. His remark was, "If I see everything of interest to me, I'll never come back". Yevjevich visited Australia six more times on different missions.

4.2 VISIT TO THE SYDNEY AREA AND LOCAL WATER PROBLEMS. During the Kensington visit Yevjevich and his colleagues reviewed several hydrological problems in New S. Wales and visited a typical Kuala forest to see whether there was special hydrology in that forest. Observations and research continue, and analysis will decide whether that forest has specific hydrological characteristics or not. Visits around Sydney have shown interesting hydrological and water resources aspects and characteristics of a wet hydrological climate in that coastal area.

4.3 PARTICIPATION IN THE WATER RESOURCES CONGRESS AT CANBERRA. Yevjevich participated in that congress, presenting the latest research results in hydrology and practical water resources activities. It gave him an opportunity to become acquainted with that part of the climate of the country, which is abundant coastal rainfall.

4.4 MELBOURNE CONGRESS OF HYDRAULICS. Yevjevich participated in the hydraulic congress of Melbourne, covering stochastic hydraulics as an emerging part of fluid mechanics. Other than that, he visited interesting water resources structures and water supply systems, as well as water evacuation structures.

4.5 CONSULTING ON WATER RESOURCES PROBLEMS IN SOUTH AUSTRALIA BY YEVJEVICH. As his Ph.D advisee, Dr. Paul Thi was an employee of the South Australian Government in Adelaide and on his initiative difficult problems in water areas have been identified, especially those requiring the best knowledge in hydrology and hydraulic engineering. Several local problems, especially on the sector of the St. Mary's River, were identified and prof. Yevjevich was asked to comment on them on several occasions. Also, at the request of the governmental water agency, a lecture on the application of stochastic processes in water resources was conducted by Yevjevich.

4.6 REVIEW OF THE REPORT ON WATER QUALITY ON THE ST. MARY'S RIVER. The South Australia State Agency of Water Resources requested Yevjevich to review a multi-volume report on the water quality of the St. Mary's River. Because of the way the lands are irrigated and the nature of the return of flow from irrigated areas to the St. Mary's River, especially in Victoria State, existing problems with saline water create difficulties between states in finding solutions.

4.7 WATER PROBLEMS OF KARST AREAS SOUTH OF ADELAIDE. This seems to be the largest karst area of continental Australia with similar problems as those found in many other countries with large karst areas. The State Office requested Yevjevich to comment on those problems from the point of view of his experiences in Yugoslavia, a country with multiple karst areas and problems.

4.8 ROUND TABLE DISCUSSIONS ON WATER PROBLEMS IN PERTH. It was agreed that Yevjevich would deliver a full course on stochastic processes in hydrology. He was supposed to fly directly from Bali to Perth on a Malayan airline. However, the flight was delayed for a couple of days, so that Yevjevich arrived in Perth at the end of the course, which had been replaced by a round table discussion by very efficient members of Perth University.
4.9 STUDY OF TREES CREATING GROUND-WATER AQUIFER. A curious hydrological phenomenon occurs in the geological bauxite formation near Perth. Bauxite is not permeable horizontally. However, trees growing with vertical roots in bauxite create vertical porous canals when they decay. Rainwater first has to fill the vertical canals before it flows horizontally over the bauxite formation. That makes the difference between the runoff hydrographs of small and large intensity rainfall. For very small rainfall, the volume of which is smaller than that of vertical canals, there is no runoff because the volume of the rainfall doesn't fill the volume of the canals.

4.10 INVESTIGATING RESERVOIR WATER QUALITY AS IT CHANGES DURING THE YEAR. A large reservoir with research data on temperature and water density distribution during the year near Perth was used by Yevjevich to study the theoretical distribution of these quality parameters in reservoirs over space and time.

4.11 DELIVERING A COURSE ON STOCHASTIC PROCESSES IN WATER AREA IN NEWCASTLE. At the invitation of Dr. Henderson, fluid mechanics professor, Yevjevich delivered a course on stochastic processes in water area with an emphasis on stochasticity in hydraulics. The structures of stochastic processes of hydrology time process and hydraulic time process are not identical. Prof. Henderson was very interested in better understanding stochastic processes in hydraulics.

4.12 STOCHASTIC COURSE FOR PRACTICAL ENGINEERS IN BRISBANE. Under the plan of a small group of specialists on application of probability theory in Brisbane, Yevjevich delivered a special course on application of probability theory, stochastic processes and mathematical statistics to pure practical problems in civil engineering for practicing hydraulic engineers. For example, if high rainfall in a mining area cuts a railroad bridge and interrupts the transport of goods to mines and transport of ore to a refinery, how much time will the interruption last and what will be the cost of the loss of production? The only accurate answer can be obtained on the basis of probability theory and stochastic processes.

4.13 STUDY OF GROUND PERMEABILITY IN AN AREA NEAR BRISBANE. It was very feasible to improve the accuracy of determination of permeability of some terrain by using probability stochastic processes, and statistics in a practical way. In this case, it was done near Brisbane.

4.14 HELPING A P.H.D. STUDENT AT THE UNIVERSITY OF NEW GUINEA. A staff member as temporary employee of the university decided to work on a thesis in hydrology for his promotion to professor. He asked prof. Yevjevich to be his advisor by mail. Regardless of the enormous distance between the two of them and the slow exchange of letters, Yevjevich accepted and the connection by telephone was much better than expected.
5. AUSTRIA

5.1 EXPERIENCE WITH THE OPERATION OF EXISTING HYDROPOWER PLANTS ON THE DRAVA RIVER. Some upstream plants were in Austria and some downstream plants were in Yugoslavia (present Slovenia). Before WWII all power plants were in the same hands and operated in the most economical way of the regional electricity system. After the war, the border between the two countries separated the system into the upper and lower plants. The Austrians continued to operate their plants in a manner that was in their best interest neglecting the interest of the downstream group of plants. When the Austrians refused to even talk about making solutions that would have been in the best interests of both countries, the Yugoslav Electrical Power Authority gave the assignment to Yevjevich to find a solution to the controversy. Yevjevich proposed to return to the pre-war type of operation, which the Austrians refused. With the concurrence of the Yugoslav Power Authority, Yevjevich found the solution from the Yugoslav point of view. In an article, Electroprihvreda Magazine, Yevjevich proposed that the Slovenian authorities increase daily regulation storages in the first power plant below the Austrian border and thus decrease the average height of the Austrian HP and operate the new storage only in the interest of both sides. Both sides agreed on the new position.

5.2 PLANNING THE UTILIZATION OF THE REMAINING HYDROPOWER OF THE DRAVA RIVER. The two electrical power authorities, Slovenian and Austrian, agreed to jointly utilize any remaining raw power on the sectors of the Drava River between the two countries.

5.3 IMPORT OF HYDROPOWER TO WEST-EUROPEAN COUNTRIES FROM THE LOWER DRINA RIVER BY CONCESSION. As a consequence of electric power politics between Austria and Slovenia, the Yugoslav power authorities proposed to the Austrian power authorities to eventually import some power from concession which would be given to Western countries by the owners of hydro power on the Drina River.
CONTENTS: (1) Yevjevich actively helped Prof. Tison of the University of Ghent in the initial phases of the formation of the international association of hydrology. (2) Participating in a group of hydrologists who created an advanced science of hydrology. (3) Participating in the civilian NATO program on science and technology and helping its director, Dr. Da Cunha, and working as the director and organizer of several NATO institutes and workshops. (4) Cooperative projects between East and West European countries.

6.1. ORGANIZING THE INTERNATIONAL ASSOCIATION OF HYDROLOGY. The creation of the association was very slow, because at the beginning of the international activities, hydrology was not based on mathematical and physical concepts but rather on geographic, descriptive concepts. Entire books were published without sound mathematical formulation or well-illustrated graphic presentations. Yevjevich was very active in helping prof. Tison to acquire a solid mathematical base for hydrology.

6.2. INTERNATIONAL HYDROLOGY ORGANIZATION BECOMING A SCIENTIFIC DISCIPLINE WITH REASONABLE ENGINEERING ASPECTS AND PHYSICAL LAWS. Yevjevich was one of the hydrologists who supported multiple branches of hydrology instead of being only hydro-meteorology, surface water hydrology and groundwater hydrology. This concept was developed and introduced in good measure with the support of USGS, UNESCO and individual scientists like Yevjevich. The concept "hydrological sciences" is now widely used in practice.

6.3. NATO CIVILIAN PROGRAM. When NATO created a civilian program in hydrology and environmental sciences, the intention was to develop a bridge between hydrological and environmental activities in East European and in NATO countries. The NATO program consisted of financing workshops and symposia and other types of meetings between scientists and engineers of the countries involved. Yevjevich was the director of, and principal contributor to, several symposia. Being that he lived under an East European regime for years it proved easy for him to understand scientists and engineers from both East European and Western countries. Several proceedings of the congresses and other events have been published.

6.4. REVIEW OF COOPERATIVE PROJECTS BETWEEN EAST EUROPEAN AND WESTERN COUNTRIES: The idea to make a bridge between East and West in hydrology and environmental sciences was the objective the fourth topic. The UNESCO program has helped bridge the two approaches. In these approaches the objective was to control pollution from either civilian or military activities, especially those causing poisoning of the long run. Yevjevich was instrumental in identifying the key conditions of polluting activities in many areas of the world.
LIST OF 20 SUBJECTS, SELECTED BY PROF. YEVJEVICH AS EXAMPLES OF HIS CONTRIBUTIONS TO WATER RESOURCES DEVELOPMENT OF BOSNIA & HERZEGOVINA.

List of structures, projects, studies, revisions of projects and other works by prof. Yevjevich, which can be considered as his contributions to the development of water resources of Bosnia & Herzegovina.
BOSNIA and HERZEGOVINA

1. Revision of the feasibility report of HE Jablanica.
2. Revision of the feasibility project of HE Rama.
3. Study of the interaction between the normal gauge railroad along the Bosna River and water resources plan the Bosna River.
4. Revision of the feasibility report of HE Jajce II.
5. Utilization and protection of the karst poljes of Bosnia & Herzegovina.
7. Potential marketing of hydro-power from the Lower Drina River.
8. Revision and supplement of the water resources plan for the Neretva River basin.
10. Capture of underground water at the Bosna River near Trebinja before it passes under the channel of the Trebinsica River.
11. Dilemma whether to build one or two tunnels for HE Chapljina.
12. Water problems of four rivers, Drina, Trebinsica, Neretva and Bosna, replaced by small rivers: Sutjeska, Zalomka, Neretvica and Zeljeznica.
13. Supply Sarajevo with water during the 1990's civil war.
14. Potential export of hydro-power to Northern and Southern Italy.
15. Potential for the accumulation of water for the irrigation of Mostarsko Blato and concepts of its complete water resources regulation.
16. Arranging the region of the Lower Neretva River for the planning of water resources schemes of that part the River up to the Adriatic coast.
17. Study of special characteristics of underground karst connections.
18. Derivation of water from the South-West to the North-East of Bosnia & Herzegovina.
19. Exploration of why it was not possible to close underground rivers and their tributaries.
20. Active consultant on the Trebinsica River plan.

NOTE: Contributions to Bosnia & Herzegovina water resources development by prof. Yevjevich have been described in a Serbian-language report of 19 pages and 19 figures. Only the list of topics from that report is described above. The intention is to translate the report into English, time permitting.
THE MAJOR STATES: Brazil, Argentina, Chile, Colombia, Peru, Venezuela, Paraguay, Uruguay.


THE MAJOR RIVERS: Amazon, Parana, San Francisco, Uruguay.

Only Brazil is described in detail with regards to Yevjevich's main contributions to the region.
CONTENTS: (1) Visiting the Rio de Janeiro area, lecturing at the University of Rio and visiting hydrolab. (2) Studying developed and yet-to-be-developed hydropower in Brazil. (3) Visiting Campina Grande and lecturing on stochastic processes in hydrology at the Extention of the University of Sao Paulo. (4) Delivered a full course on stochastic processes in water resources area for a full month at the University of Sao Paolo. (5) Keynote speaker on the future of hydrology research at the celebration of the 100th anniversary of the laboratory in Curitiba. (6) Discussion of the Porto Allegre laboratory program. (7) Review of the project to compute evaporation from the future reservoir on the San Francisco River. (8) Study of the efficiency of transmission of electric power from the HE Itajuru to consumers, connecting about 50 large hydropower plants in South America with 40 hydropower plants in Southern Brazil, with the result of increasing 700 M guaranteed hydropower. (9) Review of the results of laboratory investigations of the Itajuru water supply.
8.1. PROFESSIONAL COOPERATION BETWEEN YEVJEVICH AND BRAZILIAN PROFESSORS & ENGINEERS. The beginning of the cooperation in water resources area started in Rio de Janeiro, with lectures at the University of Rio. Following the first contact, students began to visit CSU, some of whom enrolled in the post-graduate program of the University. Most of the Brazilian graduate students were from hydro-electric power organizations. Those students have been instrumental in creating the cooperation between US and Brazilian electric power institutions. It should be emphasised that Brazil is the largest hydro-power system in the world, In addition to having much more hydro-electric power production than thermal power production.

8.2. STUDY OF DEVELOPED AND YET-TO-BE-DEVELOPED HYDRO-POWER. Yevjevich's doctoral dissertation was on the methods of investigating natural hydro-power potential. The engineer D. Catic immigrated to Brazil and took with him a copy of that dissertation. He studied the potential of Brazilian rivers and consulted with Yevjevich at every opportunity. From time to time he presented the results of his studies to the Brazilian electrical power authority. Electrobras was a leading electro-power organization for the investigation of new developments in hydropower. They consulted with Yevjevich on the implementation of his methods. Several leaders of that organization visited Yevjevich in Ft. Collins, CO, on their USA trips.

8.3. VISIT TO CAMPINA GRANDE. Campina Grande had an Extention of the University of Sao Paulo and was especially interested in hydro-power. The first invitation to Yevjevich to systematically lecture in the application of stochastic processes in water area was in Campina Grande. Also, Campina Grande invited CSU graduates of foreign descent to apply for professorship there, which they did.

8.4. LECTURES IN STOCHASTIC PROCESSES IN SAO PAULO. The University of Sao Paulo Hydraulics Department invited Yevjevich to deliver a full course on probability theory as applied to water resources, using the most up-to-date mathematical statistics. This could be considered one of the most successful courses which Yevjevich delivered abroad.

8.5. KEYNOTE SPEAKER DURING THE 100TH ANNIVERSARY OF THE HYDRAULIC LABORATORY OF CURITIBA. Yevjevich was invited to be a keynote speaker on the future of hydrology research by his ex Ph.D. student, Dr. Francisco Gomide, who at the time was the director of the electric power authority of the state. The content of the speech was very surprising to the participants. They suggested that it be published in a hydrology journal, which he did.

8.6. RELATIONSHIP BETWEEN YEVJEVICH AND STAFF MEMBERS OF THE HYDRAULICS RESEARCH LABORATORY AT PORTO ALLEGRE. The only difficulty that Yevjevich had with his Brazilian colleagues was in Porto Allegre. The Colorado program for Ph.D. degrees involves courses and thesis. Immigrant engineers to Porto Allegre insisted on using a European Ph.D. candidate system. The pressure on Yevjevich was such that he had to ask authorities to rule out his participation as a Ph.D. advisor.

8.7. COMPUTATION OF EVAPORATION FROM THE LARGE RESERVOIR DESIGNED ON THE SAN FRANSISCO RIVER. Electronas computed the evaporation from the S.F. River using a method gathered through literature. The total quantity of the evaporation per year was such that the Electrobras leaders could not accept it. They asked Yevjevich to review the computations. Yevjevich found that their computations did not take into account the return of the evaporated water on the watershed of the reservoir. In other words, one part of the evaporated water returns into the reservoir without leaving the watersheds. Yevjevich scrutinized the evaporation from large bodies of water and land, especially from the Amazon region and Lake Victoria in Uganda. He found a precipitation of 1,000 mm in the center of the lake, about 400mm on the edges, decreasing to 100mm at a sufficient distance from the lake. That shape of the evaporation surface can only be obtained if a large portion of evaporated water returns as rainfall. 80% of the evaporated water from the Amazon returns as rain over the Amazon area. A similar figure was found for Lake Victoria. The relationship of the percentage of returned evaporation as rainfall increases significantly with an increase of the size of the land or the lake. Yevjevich's estimate was accepted by Electrobras.
8.8. EFFECT OF H.E. ITAIPU ON GUARANTEED HYDRO-ELECTRIC POWER OF BRAZIL. The power produced by Itaipu has two effects on the guaranteed hydro-power of Brazil: (1) its own guaranteed power, the 12 million kWh installed capacity, regardless of any connection with other HE plants; and (2) the power transported by two transmission lines to the East Coast of Brazil, at the same time connecting the Northern Southern hydro-power plants. These are 60 very large power plants in the North-East, and 40 other plants South. Mr. Celo, an electrical engineer of Electrobras, asked Yevjevich to assess the reliability of the computations, which showed that connecting 60 and 40 power plants into one unique system increases the guaranteed power by 700 MW because of the transmission and not because of the power production. Mr. Celo accepted these results and Brazil's production of hydro-power increased by 700 MW.

8.9. EFFECTS OF EVACUATION OF LARGE FLOODS ON THE ITAIPU DAM. The design of the spillway showed that it had tremendous pressure on the energy dissipation in the basin downstream of the spillway. Investigation of the rocks in the spillway basin showed there were weak parts at several places under high pressure from the overflowing water. Those places should be watched carefully. If erosion occurs, they should be protected.
9. BULGARIA

9.1. HELPING BULGARIAN STUDENTS DURING THEIR STUDIES IN YUGOSLAVIA AND THE U.S.A. When Yevjevich was a 4th year student at the Civil Engineering Department of the University of Belgrade, he lived in a student dormitory. A Bulgarian student by the name of Stefan Stancev, came to study civil engineering in Belgrade. The Ministry of Foreign Affairs of Yugoslavia insisted that he be in Yevjevich's room and recommended that Yevjevich help him, due to the differences in educational systems of the two countries. Yevjevich filled the role well. The student became a professor of hydraulics at the University of Sofia.

9.2. VISIT TO BULGARIA DURING YEVJEVICH'S SABBATICAL LEAVE IN 1968. Yevjevich visited prof. Stancev and reviewed his on-going hydraulics research program and suggested some bilateral studies in hydraulics. Together with prof. Stancev he visited several rivers that were notorious for their levels of pollution. Yevjevich suggested some measures to alleviate the problems of the worst cases.

9.3. NATO-FINANCED RESEARCH INSTITUTE ORGANIZED BY YEVJEVICH & BULGARIAN PROFESSORS. The topics were environmental problems in Western and Eastern European countries and the U.S.A., as well as water supply and sewage problems and solutions. Special attention was given to industrial pollution of rivers in Bulgaria.
10. BURMA

10.1. ASSESSMENT OF HOW DEVELOPING COUNTRIES USED THEIR OWN SCIENTISTS AND ENGINEERS. The U.N. asked Yevjevich to evaluate developing countries' use of their own Western-educated scientists and engineers. Yevjevich selected Burma, India and Pakistan and visited Rangoon, New Delhi and Islamabad. In Burma he found that all educated professionals were nearly buried under piles of papers. In other words, the measure of professional work was based on the amount of paperwork. Entering the Office of the Ministry of Power and Water, Yevjevich was surprised to not be able to see the official sitting behind his desk, due to volume of papers.

The director of the U.N. Economic Commission for Asia & the Far East was in Rangoon at the same time Yevjevich was there. Yevjevich showed him how difficult it was for Burmese professionals to operate while buried under piles of paperwork. The visit to the three countries revealed that only directors were sufficiently paid. Consequently, the only employees were directors.

10.2. STUDENTS AND POLITICS OF THE COUNTRIES. It was evident that politics played an essential role in the distribution of stipends to students from Asian countries. Therefore, it should be understood why the bureaucracy is very deeply rooted in many Ministries of those developing Asian countries.
11.1. VISIT TO ANGKOR WAT AND ANGKOR THOM. Mr. Kulkami, electrical engineer from India, was administering the course on methods of investigating hydro-power in Bangkok. One weekend he suggested to Yevjevich to rent a car and to visit the two medieval temples. Yevjevich accepted the invitation and a group of several participants of the Bangkok course went along to visit the temples. Yevjevich was so impressed by the structures, regardless of the decomposition of the rocks and lack of good maintenance of the temples, that even to this day he keeps several photos of these temples in his office. Yevjevich wrote letters to the U.N. and the Cambodian Government, regardless of the Phnom Penh regime, pleading for the repair, protection and proper maintenance of these South-East Asian cultural treasures.

11.2. CAMBODIAN STUDENTS AT CSU. Several Cambodian students were sent to Colorado State University to obtain Master's Degrees. Yevjevich insisted on discussing how to repair and protect the damaged structures. He suggested that the students write the history of those monuments, and design the protective rules for the future. He particularly appealed to them that their duty, upon their return to Cambodia, was to repair the damages sustained during the recent Cambodian revolution.

CONTENTS: (1) Collaboration between Yevjevich and Canadian hydraulics specialists; (2) Exchange of ideas on the way hydropower of Quebec should be investigated; (3) Exchange of ideas on stochastic processes in hydrology at the University of Montreal; (4) A large number of students coming to study for their Ph.D at CSU under prof. Yevjevich; (5) Extremely important development of dual cavity approach to the solution mining of potash in Saskatchewan; (6) Increasing the size of the crystals of potash for fertilizing purposes; (7) Helping the hydraulic engineer Saito in his study of water resources problems of the Peace River in Western Canada; (8) Development of a video cassette on geophysical time series at the Canadian Institute of Hydrology; (9) Collaboration with Dr. Klemish on stochastic time series in water resources area; (10) Keynote speaker at the Ottawa Congress of the International Water Resources Association (IWRA).
12.1. COLLABORATION WITH CANADIAN HYDROLOGISTS. Yevjevich was active in the International Association of Hydraulic Research. In 1956 he was VP of the Association’s Council and participated in the congress at Montreal. He got acquainted with the leading specialists in hydraulics and from that time he cooperated with them on their research efforts for many years. Also, since 1958 he received Canadian students at the CSU graduate and research programs in water resources.

12.2. INVESTIGATION OF HYDROPOWER OF QUEBEC. The hydropower of Quebec is only second in size to that of Brazil. That size, coupled with the sparse population, has made hydropower the main source of electrical power in Quebec. Therefore, it was logical that some Canadian engineers knew about Yevjevich’s method of investigating power quantity. It wasn’t surprising that they always liked to discuss hydropower development with him. The fact that his former students became consultants to Quebec Hydropower can be considered as extending influence of his knowledge and developments on the application of probability theory, stochastic processes and mathematical statistics in the area of hydropower up to the model design and operation of large hydropower plants.

12.3. STOCHASTIC PROCESSES IN HYDROLOGY AT THE UNIVERSITY OF MONTREAL. The application of stochastic processes in hydrology developed very slowly. As the university professors followed the developments of stochastic processes in the U.S., it was logical that they came into contact with not only the US Geological Survey in Washington, D.C., but also with prof. Yevjevich. In that way, Yevjevich was in contact with professors at the University of Montreal since the early 1960’s.

12.4. CANADIAN STUDENTS AT CSU, FT. COLLINS. A large number of Canadian students came to study at CSU for their graduate degrees in water resources engineering and hydrology.

12.5. DUAL CAVITY APPROACH TO POTASH SOLUTION MINING. Several enterprises were involved in Saskatchewan in solution mining at the start of the 1960’s. Apart from Canadian firms, many smaller and larger firms from several other countries had concessions from the Government of Saskatchewan to mine a one-mile deep, 11-meter thick layer of salt. Among those firms is Kalium Chemicals, Inc., a consortium of several large U.S. chemical companies, such as Pittsburgh Plate Glass. Some especially important aspects of the mining of potash by Kalium Chemicals were described in Yevjevich’s report on his work in the U.S.A.

The composition of the salt ore is approximately 52% of NaCl and 48% of potassium chemical (potash salt). Usually two methods are available for mining soluble ore from deep layers. Either the ordinary well, or pipe drilling. The classical way is to use two pipes, one inside the other, and pump water down through the inside pipe, the brine coming out through the space between the two pipes. The basic limiting factor for the use of small and large pipes is the resistance to the flow of the liquid going through both pipes. The cavity in which the salt solution is made is usually cylindrical, up to a diameter of 300 meters. Since oil does not dissolve salt and floats on water, it maintains a controlling level in the cavity.

Kalium Chemicals started with the concept of every cavity being a separate project until Yevjevich became their consultant. One day three chemical engineers came to CSU, Ft. Collins and asked to meet with professors of fluid mechanics and hydraulics. They presented their project to eight professors. Yevjevich was the last of the eight professors to present his point of view. They left CSU without having selected any consultant. A few days later, Yevjevich got a call. He had been selected to be their direct consultant. He was asked to come to Denver to negotiate the contract. Yevjevich suggested that the company give the contract to CSU for all hydraulic laboratory investigations. He accepted the consultancy on the basis of the rules governing professors’ consultancy. The rule was that the consultancy could last one day per week on the professor’s own time, which was usually on a Saturday.

Both contracts were signed. A couple of months later Yevjevich came with a proposal. After he got the group of chemical engineers and the director of Kalium Chemicals to review his proposal, he called it the “Dual Cavity” method. The distance between the centers of the two cavities was 300 meters. He suggested that the cavities be connected by water jets, directing one stream to the other and thereby successfully creating a small connecting corridor in the salt layer. They retained only the large pipes in each of the two cavities, taking out the small pipes. By sending water through one large pipe, the brine would go through the connecting hole and come out of the large pipe, thus increasing the quantity of brine produced. One of the chemical engineers calculated that the cost of potash produced by the dual cavity project was only 14% (177) of the cost of the same quantity produced with the two single separate cavities system.
This proposal convinced Kalium Chemicals that Yevjevich could do other things as a consultant. Examples: Planning the project of copper solution mining or retorting oil by creating porosity and extracting oil by fire. Yevjevich's studies showed that these projects are unlikely to succeed. Copper is a relatively small percentage of rock. It will be difficult to create the required porosity that would permit a high contact between copper molecules and liquid. Also, retorting oil shells for oil will be hard since fire will close the porosity.

Figure 5A: Two single-cavity production of potash brine in Saskatchewan with water coming through small diameter pipes and potash brine going out of the cavity through the annulus (space between the large and small diameter pipes).

Figure 5B: Transforming the two single-cavity production into a dual system production by connecting the two cavities, using directional jets to create the corridor between the two cavities.

Figure 5C: With the successful connection of the two cavities by the small corridor, it is possible to take out both of the small pipes from the cavities. In that case, water comes through one large diameter pipe into one cavity and exits as potash brine through the other large diameter pipe of the other cavity. In this way, frictional resistance is significantly reduced, compared to that of the two single-cavity system. This creates a large advantage over the other system. Brine saturated with both potash and NaCl comes out of the cavity and by proper crystallization, potash is extracted in the form of crystals. Then brine saturated only with NaCl is used for production. Only potash will be dissolved by the brine. The surplus of NaCl crystals is used to fill the cavity at the end of its use, so there will be no settling of the terrain due to the extraction of potash. According to one chemical engineer of Kalium Chemicals, the introduction of this system cuts the production cost of potash by 86%.
12.6. INCREASING THE SIZE OF POTASH CRYSTALS FOR FERTILIZING. The original crystals produced from the crystallizer in Regina, Saskatchewan, were relatively small according to farmers' demand. Farmers requesting the fertilizer complained about too small crystals and continuously asked Kaliun Chemicals to increase the size. Though Yevevich was not very well versed in crystal technology, he looked at it from the point of view of fluid mechanics. By experimenting with the crystallizer, he was able to increase the size of the crystals and satisfy farmers' demands. That enhanced his image as an experimenting engineer in fluid mechanics and hydraulics. Kaliun Chemicals requested that he look into the short lifespan, of six months, of kiln bricks in Corpus Christi, TX. Yevevich experimented and solved the problem by redistributing the size of broken limestone rock as well as redistributing the quantity of gas in kiln, so that the fire didn't concentrate at the contour of the bricks. That increased the lifespan of the bricks a couple of times.

12.7. HELPING THE STUDY OF THE DEVELOPMENT OF WATER RESOURCES OF THE PEACE RIVER. Mister Sabljak, a Croatian water resources engineer, immigrated to Western Canada, and worked on the water resources development of the Peace River. In his work, he often consulted with Yevevich because they had had cooperated very well on the design of the HE Jablanica in Bosnia and Herzegovina. This strengthened Yevevich's connection to hydraulics engineers in Western Canada. Since Yevevich was the editor of methods of planning water resources development in Yugoslavia and author of the book "WATER RESOURCES SCHEMES" in 1948, Sabljak relied on his help whenever he needed Yevevich.

12.8. HELPING THE DEVELOPMENT OF A VIDEO CASSETTE ON GEOPHYSICAL TIME SERIES. At a symposium on time series, held in Edmonton, Dr. Klemesh, Dr. Rao and Yevevich conducted a combined presentation and created a video on geophysical time series. At that time the Hydrolc Institute of Canada was in the West, mainly concerned with the application of stochastic processes in hydrology.

12.9. COLLABORATION WITH DR. KLEMEH ON STOCHASTIC TIME SERIES IN WATER RESOURCES AREA. When the Russian Army invaded Czechoslovakia, Klemesh was participating at a scientific meeting in Dubrovnik, Yugoslavia. There he met Yevevich for the first time and asked him whether he could help him immigrate to the USA, as he didn't want to return to his native city, Bratislava. Yevevich told him it would be much easier for him to enter Canada first, and from there, eventually the USA. He moved to Canada and became one of the leaders in research on scientific hydrology and applied mathematics to hydrology.

12.10. KEYNOTE SPEAKER AT THE OTTAWA CONGRESS OF THE IWRA. Prof. Yevevich was one of the founders of the International Water Resources Association as well as the professional journal, "WATER INTERNATIONAL". He cooperated closely with Prof. Ven Tat Chau, professor of water resources engineering at the University of Illinois, Urbana, Ill. Mr. Stout was the President of the IWRA Council at the time of the Congress. He invited Yevevich to deliver the keynote speech at the IWRA Congress, which he eagerly accepted as an opportunity to present his summary of research on the application of probability theory and stochastic processes to water resources engineering. This was published in the proceedings of the Congress.
13.1. STRUCTURE AND ECONOMICS. "Central America" is composed of the following seven independent states: Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. The upper part of the chain of states is highly influenced by Mexico, the lower chain by South American countries. The economies are highly dependent on the US, with import of industrial goods and technology paid for by the export of agricultural products. Although Mexico, Haiti and Cuba may also be considered parts of Central America, in this report they are not. The most important structure in Central America is the Panama Canal, which, after many years under US control, passed to the control of Panama.

13.2. GRADUATE STUDENTS AT CSU. Yevjevich's experience with Central American countries was only in two areas: a) Advising graduate students in water resources area, who came to CSU for MS and Ph.D. degrees in hydrology and hydraulic engineering; b) Advising professors at universities of those countries in teaching and research, usually under UN or US sponsorship.

13.3. VACATION AND RETIREMENT. US citizens very often spend their vacation in Central American states. Also, it is not rare for Americans to retire there, for example in Costa Rica, because the lowest US income group retirees can still enjoy a good retirement in this region.
CONTENTS: (1) Historical monuments around Peking; (2) Historical monuments around Harbin, Mongolia; (3) Mongolian border; (4) U.S.S.R. border; (5) The Chinese Wall; (6) Mukden area; (7) Inner Mongolia; (8) Nanking area; (9) Shanghai; (10) Hankow; (11) Chungking; (12) Chengtu; (13) Upper Yangtze; (14) Three Gorge project; (15) Yangtze River; (16) Canton; (17) Hong Kong; (18) Hainan; (19) The Gulf of Hainan; (20) Nanning; (21) Kunning; (22) Gwallin.
14.1. PEKING. Usually, Peking is in everybody's plan when they visit China. In 1954 Yevjevich was sent by the Yugoslavia Electrical Power Authority to the Conference on Electric Energy in Vienna, Austria. There, the Yugoslav delegation invited him to a dinner. During the dinner it was suggested that he come to China as a consultant to work on hydroelectric development. Yevjevich replied that he already had a pending invitation by the US National Academy of Sciences for an 18-month joint research on river floods. Later, when he was already established in the bilateral conference on electric power and water between China and the US was organized. The US Government asked Yevjevich to be responsible for the planning and implementation of the program in the area. In Peking he met with the same three Chinese engineers with whom he had had dinner in Vienna. He could extract from one of them what the consequences were of Mao Tse Tung's Red Guards Revolution: of the engineers had all the literature on hydroelectric in six languages. The Red Guards had confiscated the books and burned everything in a square.

14.2. HARRBIN, MONGOLIA. During the above conference, the US delegation visited this area. That provided more information to the delegates than the Peking conference itself. Also, the delegates visited the areas in which hydroelectric power development was more promising. For Yevjevich, the result of the conference was that he became very interested in the Chinese water resources development. This interest would bring him three more times to China. Once, he was invited by Chengdu University to deliver a one-month course on stochastic processes in hydrology to 150 Chinese student engineers (see 11: Chungking). Another time, he went to a conference in China. The next time he was a member of the US Governmental Delegation, on an official visit to China.

14.3. MONGOLIAN BORDER. The US delegation, visiting China on an exchange basis, requested to see the area that was going on in the desert bordering Mongolia, and in Mongolia proper. Yevjevich had a special interest in the Gobi Desert came about and why it continually stays as a desert. When Yevjevich was invited to Formosa to deliver a lecture on the application of mathematics and statistics in hydrology, he met with Professor Mao, who gave him small models of vessels used for cooking meals and boiling water. Three thousand years ago, someone discovered that by cooking a meal and boiling water, intestinal diseases would all but disappear. At that time, the Gobi Desert was lush with vegetation. People living there engaged in activities that resulted in deforestation, burning trees to create fire, in order to cook. This method of controlling diseases survives to this day. When Yevjevich was in China, he had to apply this method of cooking meals and using water for washing. The US Delegation also visited the works on the control of soil erosion. This work by the Chinese was very impressive and probably the best of its kind in the world.

14.4. U.S.S.R. BORDER. The US Delegation visited the Chinese-U.S.S.R. border because from time to time some disturbances occurred in that area. During that trip the Delegation learned about Chinese rules for everyone traveling through China. Travelling from Peking to the Siberian border, the Chinese officials asked the Americans not to go beyond their county border. Instead, they would be replaced by another group of officials upon entering a new county.

14.5. THE CHINESE WALL. Knowing that photos taken from the Moon show the Chinese Wall as a distinct feature on Earth, Yevjevich went to see the wall three times. He was impressed by the way the wall was built. But, at the same time, he felt the tremendous suffering that must have been endured by the people who built the wall. The wall is a major tourist attraction. Each time Yevjevich went there, masses of people were visiting the wall. The US Delegation was very impressed by the tombs of the leaders of the Ming Dynasty. The tomb chambers were excavated in rocks, decorated with paintings and sculptures, and sealed. Tourism justified the opening of several of the tombs to visitors.

14.6. MUKDEN AREA. Mongolia and Northern China area typical producers of good meat. Since the climate is dry, and normally droughts come in intervals governed by probability theory, the problem of survival of the population during those periods of drought is a critical factor. During the relatively wet period, in between drought periods, the climate permits the development of agriculture, which can support large quantities of
animals. When drought hits the area, the question of survival of the cattle on which the population depends, as well as the disappearance of vegetation, becomes of paramount importance. The history of Europe is full of invasions of tribes from these and other areas, conquering Western regions for food and water. Studying the distribution of drought in time and space of different areas of Europe, Asia, the Americas and Africa, Yevjevich concluded that historians are not right that drought came to this area regularly. He found that drought occurs purely by chance. Genghis Khan received fruits and vegetables from the Persian Gulf by horse relays, except when droughts occurred, when the system could not be maintained.

14.7. INNER MONGOLIA. This region consists of predominantly arid land. How did it happen that most of the Chinese Dynasties came from this area? The only explanation is that the wet periods produced large quantities of animals such as sheep, horses, other domestic animals, as well as agricultural products, which gave the inhabitants the means with which to conquer the surrounding areas and impose their rule on others. Exactly the opposite happened during the dry periods.

14.8. NANKING AREA. This region in the Yangtze River Valley has been one of the largest producers of food. It is not surprising that Chang Kai Shek selected this area as the seat of his power. The fact is that the best Chinese technical university is in this area. It usually attracts youth from East China.

14.9. SHANGHAI. The fact that the Yangtze River reaches the sea at Shanghai, with all the commercial activities of a major seaport occurring here, makes the city China’s main business center. It is also the cultural center of the country.

14.10. HANKOW. This is the center of South-East China. The area produces tropical food. It doesn’t have large climatic variations.

14.11. CHUNGKING. This city is on the Yantze River, and is famous for its Sun Yet-sen monument, in memory of the reformer of the Chinese Government who replaced the Chinese Dynasty with a democratic regime. Traveling by boat on the Yangtze River, this place was visited by Yevjevich, who was invited by the Eastern China Technical University to deliver lectures on the application of stochastic processes in hydrology. Also, he discussed on-going water resources problems in developing China. Yevjevich went to the Sun Yet-sen monument because he considered him one of the most enlightened Chinese statesmen.

14.12. CHENGDU. The Western Chinese Technical University invited Yevjevich to deliver a full course on the application of probability theory and stochastic processes in water resources engineering. When Yevjevich arrived at Chengdu, accompanied by his wife, he was surprised by the number of participants that took part in the course. He was lucky to have a good Chinese translator-engineer from Makao (who later came to study in Baton Rouge, LA). Yevjevich was also surprised to see two of his books, one of which was translated in Mandarin. Nobody had ever asked for permission. The difference between Chengdu and Formosa is that in Formosa they had decreased the size of the xeroxed (English language) book without permission, while in Chengdu they had translated it. Judging from the Q & A after the lecture, it was evident that all the participants had studied Yevjevich’s books, since their questions were very pertinent. An older professor of hydraulics got better acquainted with Yevjevich. Yevjevich learned that his daughter had been forbidden to have any education. Being the daughter of a "reactionary", she worked as a servant in a restaurant. Yevjevich was very impressed with the old irrigation system used in the Plain of Chengdu, which had 100 million inhabitants. Discussing irrigation concepts, Yevjevich suggested a third reconstruction of the entire irrigation system. Efforts by the group of professors, including Yevjevich, to see Pandas in the forests around Chengdu were unsuccessful. Yevjevich also visited the upper end of the Yangtze River, where the level of the Three Gorge Reservoir will end. That visit later helped him to discuss that project in Wuhhan, where the seat of the Yangtze River Water Commission was located. Up to this day he keeps the exchange of letters with the professors whose specialty was water resource engineering.
14.13. UPPER YANGTZE. This term, "Upper Yangtze", is related to the upper part of the Three Gorge Reservoir, which is at present being build. Yevjevich knew that in Western Europe and the USA discussions would take place on whether the project should be built or not. Yevjevich had a lot of arguments in favor of the project's being built, and belonged to a minority of Western professionals who considered the Chinese must build the project if they want to feed their population by the end of the 21st Century. Critics have been especially against the flooding of the plain, requiring about 1 million people to be evacuated and re-settled in the plain with a population of 100 million. Visiting the area of the plain which would be flooded, Yevjevich got a much better insight in what could and should be done.

14.14. THREE GORGE PROJECT. As a member of the US Delegation visiting China, Yevjevich visited Wuhan, the seat of the Yangtze River Commission, as well as the center of the Chinese technology of sediment transport via rivers and canals. The Chinese sediment transport technology could be consider among the best in the world. However, Yevjevich's assignment was to evaluate how good the Chinese engineers were in planning water resources development. Visiting Wuhan, two events were important to Yevjevich. First, the presentation by the Chinese planners of the Three Gorge Power Project and, second, Yevjevich's lecture on the latest technology in water resources planning. In the discussion following the two presentations, Yevjevich stated that he had studied everything available in literature on the Three Gorge Project. He disagreed with most Western specialists on their position with regard to the project. As the largest power plant in the world, the project will produce hydroelectric power to pump water from the reservoir to irrigation areas in the direction of Peking. The project has to guarantee the production of food and the industrial processing of food, in order to feed the population by the end of the 21st Century. The criticism that 1 million people have to be uprooted from their homes and settled elsewhere neglects one fact. One million people out of 100 million in the area will be easier absorb than it looks, taking into account that upstream of the Yangtze River there will be other future projects, which will guarantee a sufficient food supply into the 22nd Century. Yevjevich has studied the marks of the largest floods that occurred in the area of the project. He has found that these signs are higher than the real level of the floods because of the waves. Based on the marks, he curve of the probability distribution of the floods has been higher than its real probability distribution curve. Yevjevich also found similar situations on other large rivers, such as the Mekong, the Danube, the Drina, etc.

14.15. YANGTZE RIVER. Two important problems have to be taken into account before the project goes into operation. First, the erosion of the riverbed downstream of the reservoir dam, with water freed of sediment by the reservoir. Second, the deposition of the sediment on the upstream part of the reservoir has to be evaluated. Furthermore, it will be of interest to many professionals how the navigation of ships at the large dam with the large fluctuation of the reservoir level will behave. Also of interest will be how much evaporated reservoir water will return as rainfall on the watershed of the Yangtze River, upstream of the dam. That means the calculated evaporation is not the total loss of water from the Yangtze River. For example, evaporation from the Amazon River basin to a large extent returns 80% of that water back to the same basin. How much the large plain of Chengdu will receive of that evaporated water has to be evaluated.

14.16. CANTON. Canton and Hong Kong are two economic giants and major competitors of each other. That competition should be turned into cooperation. One area of cooperation should be water resources development in the region.

14.17. HONG KONG. The international aspect of the Hong Kong economy may become the largest contributic to the Chinese economy in that part of China. How much the production of the Three Gorge Project will influence the Hong Kong economy depends on vision and international economic knowhow. An assessment is called for as early as possible because outside investment capital is one of the major benefits to South-East China. Water resources investment is capital intensive on the long run, and Hong Kong is the ideal place to attract capital.
14.18. HAINAN. The Island of Hainan represents similar economic aspects for China as other large islands do for other nations. The tendency of such islands to move towards independence manifests itself all around the world. Colorado State University has been a magnet for two groups of graduate students from Formosa, namely those Ph.D. graduates who go back to Formosa and work in water resources area, and those who obtain jobs in the US and remain there as immigrants. Usually they fill either the higher positions in university-level education and research, or in county offices for flood control and water supply. Hainan is in a tropical belt of Asia and usually permits the production of most high-value tropical food.

14.19. THE GULF OF HAINAN. The tropical climate is subject to typhoons (hurricanes). The gulf is rich with fish and the major obstacle to harvesting good sea crops is the threat of severe weather conditions disturbing fishing and the use of fishing boats. Due to political controversies among South-East Asian countries, the Island of Hainan has not succeeded in developing and fulfilling its tourist potential.

14.20. NANNING. This is a typical example of the South-West Chinese coastal climate. Yevjevich has not bee interested in such areas, since it features good and bad climatic conditions. This terrain is ideal for a joint planning of water resources development between China and Vietnam. The defense against hurricanes also lends itself for joint operations. Similarly, it is done this way between India and Pakistan, as well as between China and India.

14.21. KUNMING. The planning of the joint utilization of three large rivers in Western China (Yangtze, Mekong, Irrawadi) should envisage the transfer of water between the rivers, using a system of tunnels of no more than 35 km. The connection can be made economically, and water can be transferred from countries in the region according to the needs as they arise. Yevjevich has suggested to his former Ph.D. student, Dr. Subin Pinkayar that his South-East Asian consulting firm look into the possibility of that water resources program.

14.22. GWALIN. Yevjevich consulted at the Karst Institute in Gwallin. When Chengdu University invited Yevjevich to deliver a course, the Geological Research Institute for Karst extended an invitation to him. Flying Hong Kong and Shanghai, Yevjevich stopped over in Gwallin and spent several days consulting in karst water resources issues. He has maintained contact with the institute ever since. Curiously, most US professors go to China on consultation have paid for airfare in US currency, and have been reimbursed in Chinese denomination. The exception came when Chengdu University provided the plane ticket for Yevjevich, paid for with US Dollars. A few years ago, Yevjevich, enjoying retirement, was invited to go to Gwallin by the Chinese Ministry of Geology. The reason for the invitation was that they wanted him to consult on the occurrence of the combination of drought in the region and exceedingly low flows in the river, which serves as a tourist attraction. Gwallin is one of the most attractive touristic places in China because it has natural columns of perm, an old limestone, in which chemical erosions created large cavities with stalagmites and stalactites. Yevjevich was asked to pay for the ticket in US currency. He would have received a full reimbursement in Chinese currency. Yevjevich declined the invitation, because they would not directly provide the ticket to him like before. Also, at that time he was already suffering from Parkinson disease, having an adverse impact on his ability to travel. I recommended that a Serbian hydrogeologist, Dr. P. Milanovic, take his place, which he did.
15. CROATIA

15.1. THE PERIOD WHEN CROATIA WAS PART OF YUGOSLAVIA. As the planning of water resources in Yugoslavia was centralized, it was simultaneously done in six republics and two autonomous regions. Yevjevich's major contributions were: Planning water resources development in Low Polje in Bosnia and Croatia. He was instrumental in concentrating all waters in one reservoir, flooding only the Busko Blato. His proposal to immediately build one tunnel for HE Split, and a second one later, was not accepted by the Croatian Electrical Authority, which they later regretted. He participated in the revision of all schemes, projects and plans which passed through the centralized revisi

16. CZECK REPUBLIC

16.1. WATER RESOURCES PLANNING IN A DIVIDED COUNTRY. The separation of Czechoslovakia into two countries meant having double institutions for the planning, designing, constructing and operating of water resources projects and schemes. As these structures were not terribly destroyed during WWII, because Germany needed the country for production of goods, it was not difficult to repair whatever was damaged. Yevjevich was disappointed to see the Russian invasion of Czechoslovakia, and the Communist system that was subsequently imposed on the country. He kept in touch with Czech and Slovak engineers during all those years of Communist rule.

17. DENMARK

17.1. COOPERATION WITH A DANISH STUDENT. Accepting applications for graduate research assistantship from Europe, CSU had one interesting Danish student. His idea was that assistants are paid workers. He proposed that CSU establish a workers union in the form of graduate assistants. Being educated in Europe and knowing the political situation at universities, Yevjev suggested that the student first establish a union in Denmark, before moving to the US. He turned out to be a very good hydraulic laboratory engineer, in time becoming its director. As such, he did not introduce a students union.
18. EGYPT

18.1. 3000 YEARS OF OBSERVATIONS OF THE NILE RIVER LEVEL. The size of the floods determine the size of Egypt's agricultural production. To tax the people, the pharaohs established a gauge to measure the level of floods. The larger the flood, the larger the tax. When the pharaohs needed more taxes to build the pyramids and temples, they ordered the treasurers to lower the gauge, manipulating its zero-level to their advantage. Studying historical floods, Yevjevich expected to use 3000-year-old data to show whether or not the climate changed with time. He concluded that several times during the last 3000 years the pharaohs' "zero" level was lowered, thus, for the same elevation, there would be larger floods. The Nile River forecast depends on the level of Lake Victoria. The Blue Nile, coming from Ethiopia, has higher average flows than the White Nile, coming from Uganda. In the 1950s, Yevjevich received a letter from the British hydrologist Dr. Baker, telling him the average precipitation on Lake Victoria had constantly been decreasing. Yevjevich's reply was, "We owe it to ourselves", because of the special water regime of the lake. The next year, the largest annual precipitation on record occurred. The special regime consists of evaporation, about 60% of which returns to the lake as condensation. Also, much larger evaporation in Sudanese swamps decreases the quantity of water coming through the White Nile, in comparison with the Blue Nile. The building of the large Nasser Reservoir on the main stem of the Nile has increased irrigation, but has also created secondary side effects.

19. ETHIOPIA

19.1. WATER REGIME OF LARGE RIVERS. The largest river is the Blue Nile. It creates some conflict in terms of how much water goes to irrigation in Ethiopia and how much is guaranteed to Egypt. Some aspects of the Awash River: The Serbian engineer D. Jovanovic was an advisor to the Ethiopian emperor on water resources development of Ethiopia. He concentrated on this river for two reasons. Ethiopia is a very poor country, often suffering from serious droughts. He showed that in the Awash River basin it would be easy to develop irrigation of about 400,000 hectares (nearly 1 million acres) because there is enough water for that project and all irrigation is inside the basin, thus avoiding any dispute with neighbors who depend on water flowing from Ethiopia. As the neighboring countries, mainly Arab nations, need to import large quantities of meat and other foodstuffs, Jovanovic developed the idea that borrowed money for the development of irrigation may be paid off by the delivery of agricultural products. Yevjevich twice visited Ethiopia, where some of his Belgrade students were working. He delivered several lectures at the African Commission of the U.N., the seat of which happens to be in Addis Ababa.

20. FINLAND

20.1. VISIT TO HELSINKI IN 1971. When Yevjevich was on a Fulbright Scholarship to deliver a lecture in Stockholm, Sweden, he used the opportunity to visit Finland on his way to a conference in Moscow. During his stay in Helsinki, he visited water resources institutions. He was especially interested in particular characteristics of hydrology in cold climates of Europe. He also found the natural growth of trees created a significant economic impact in the form of the timber industry.
CONTENTS: (1) Fellowship for Yugoslav graduate engineer; (2) Selection of a Yugoslav student for the design of a hydraulics laboratory for hydraulics research; (3) Apline geology experience in water resources structures; (4) Hydraulic laboratory internship in Chatoux; (5) Laboratory internship in soil mechanics, Paris; (6) Post-WWII collaboration with Prof. Escande from Toulouse; (7) Participation in hydraulic congress, Grenoble; (8) Engaging Mr. Levin as laboratory consultant at Avia Laboratory, Belgrade, Yugoslavia; (9) Member of the Academy of Toulouse; (10) Offer to Yevjevich to be a "professor" for 300 engineers at Nancy.
21.1. GRADUATE ENGINEER FELLOWSHIP. In 1937 the French Government offered a fellowship for a Yugoslav graduate student to specialize in France. In Belgrade, Yugoslavia, Yevjevich had just received his 4-year civil engineering degree with honors. It turned out he was the most qualified candidate of all applicants. He applied for studies at the School for Engineering in Paris, and was selected to start studying in October 1938. Yevjevich requested from the Yugoslav Government a leave of absence without pay to study in France for a year. The request was granted by the Ministry of Civil Engineering. Once in Châlons, near Paris, he was surprised when the French director of the school told him that the School was very mathematics oriented and that he suggested to Yevjevich that he go to Grenoble and enroll in the school for hydraulic engineers. This school required applicants to have a degree in other fields of engineering, which Yevjevich had obtained in Belgrade. He came to Grenoble, rented a room and was surprised to discover the relatively large number of Serbian students studying other disciplines. He decided not to talk to them in Serbian for a nine month period. Rather, he behaved like he was a French citizen. In June 1939, Dejan Gradjanski, a student from Sombor, Yugoslavia, studying French, discovered that another Serb — Yevjevich — did not speak with him in Serbian, even though they lived in the same building. He asked Yevjevich why he only spoke French. Yevjevich replied that he learned French this way. Yevjevich left Grenoble for England in June, 1939. Back in Belgrade, Yugoslavia, the Ministry had told him to establish a hydraulics laboratory in Yugoslavia. Knowing that, Yevjevich visited several English laboratories. Also, he studied the objectives, costs and application of laboratory rules in England. He spent July and August, 1939, in the U.K. On September 1, he learned that Germany had invaded Poland. That evening, Yevjevich went to London's Trafalgar Square, watching the demonstration of British people against Germany. He heard Chamberlain speak on the public broadcast system, declaring a state of war with Germany. Yevjevich went back to his hotel, paid the bill, took a cab and went to Dover. There, he took a boat back to France. There were only three passengers on that vessel. Once in France, he took the train to Grenoble. In the early morning of the next day, he arrived. Yevjevich picked up his things and crossed the border into Italy, thinking the Italians would close the border. This would have blocked him from going back to Yugoslavia, or so he thought. Yevjevich never received the French diploma because it never reached Yugoslavia by mail. However, in a bulletin it was announced that he had earned the degree with distinction. He was the best student of his class. In fact, the professors never examined him. Rather, the French students always asked Yevjevich for advice on academic matters, making him a de facto "assistant professor".

21.2. SELECTION OF A STUDENT FOR THE DESIGN OF A HYDRAULICS LABORATORY FOR HYDRAULICS RESEARCH. The Ministry of Public Works selected Yevjevich for the task of creating a hydraulic laboratory for the Ministry. Yevjevich spent time in French and English hydraulic laboratories, studying their objectives and how they organized commercially viable businesses without compromising scientific research. Comparing the French and English models, he developed a similar approach, which he tailored and applied to Yugoslavia, so that every Yugoslav hydraulic model also had a research department built into it. It helped him publish research papers on hydraulics from the models developed at the Avala Laboratory.

21.3. ALPINE GEOLOGY EXPERIENCE IN WATER RESOURCES STRUCTURES. Mr. Cignoux was the professor for hydrogeology in the School for Hydraulic Engineering in Grenoble. Yevjevich succeeded in being his companion during weekends, when they made field trips in the country, which gave Yevjevich experience in the application of hydrogeology under Alpine conditions. Yevjevich paid special attention to karst problems in the Alps. Several cases of failure of reservoirs to retain water were very instructive to him. Later he applied that knowledge to karst problems in Yugoslavia's Dinaric Alps.

21.4. HYDRAULIC LABORATORY INTERNSHIP IN CHÂTOLUX. Apart from the hydraulic laboratories in Grenoble, especially the Neuville Laboratory, Yevjevich considered it to be his duty to visit the hydraulic laboratory in Toulouse, and the one near Paris. Being a hydraulic engineering student, these visits, lasting several days or weeks at a time, Yevjevich was sure that he picked up whatever those laboratories could have given him to complete his objectives. He maintained very close cooperation with those three French hydraulic centers until 1958, the year of his departure to the U.S.
21.5. LABORATORY INTERNSHIP IN SOIL MECHANICS, PARIS. Studying the type of dams that should be designed at Vlasina in Serbia, Mavrovo in Macedonia and Rama in Bosnia, Yevjevich was most committed to the first earth dams in Yugoslavia. The design and construction of an earth dam requires very good knowledge of soil mechanics. In July 1959, he spent three to four weeks in Paris. During this time he met Mr. Bogdan Rajčević, who was also an intern in soil mechanics. That was a good investment of time in terms of friendship, because when Rajčević came back to Yugoslavia, he accepted Yevjevich's offer to be the key engineer of the Vlasina Dam construction. He specialized in earth-filled dams. Yevjevich planned the construction of earth-filled and rock-filled dams in Yugoslavia.

21.6. POST-WAR COLLABORATION WITH PROF. ESCANDE. At the 1949 Hydraulics Congress in Grenoble Prof. Escande got acquainted with all Yugoslav participants. He offered to Yugoslavia free consulting in hydropower, especially in hydraulic aspects of power plants. The results were interesting. The Yugoslav Government accepted him as an advisor. Escande did not charge the Yugoslav Government anything. Rather, he used UN, French Government and other available funds for developing countries. Toulouse was not only famous for hydraulic power plants, but it also had a good program for the investigation of groundwater, whose leader was Mr. Nougaret, with whom Yevjevich still cooperates to this day. In a meeting in Spain they discovered that the best stochastic models in hydrology is the one whose physical process can support the stochastic model.

21.7. HYDRAULIC CONGRESS, GRENOBLE, 1949. The 1949 congress renewed the interaction between hydraulic engineers of East and West Europe. French engineers played a very important role at the congress. Yevjevich met Mr. Levin, a Russian-educated hydraulic engineer and a naturalized French citizen. Due to a heavy workload (Director of a water resources research institute, Director of Hydro Bio, leading reviewer of projects, member of project revision commissions, designer of a water resources scheme for several river basins in Yugoslavia, designer of dams and powerplants, etc.) Yevjevich at the time wasn't able to fulfill every duty right away, and so he needed a qualified assistant. This is where Mr. Levin would come in.

21.8. MR. LEVIN, LABORATORY CONSULTANT AT AVALA LABORATORY, BELGRADE, YUGOSLAVIA. At the 1949 congress, Yevjevich invited Mr. Levin to come to Belgrade to work on the above tasks (21.7) especially at the Avala Laboratory. Levin was very helpful in the study of the propagation of floods from broken dams, movement of water and air mixture on spillways and other similar structures.

21.9. MEMBER OF THE ACADEMY OF TOULOUSE. On Prof. Esclangon's initiative, Yevjevich was elected a corresponding member of that Academy. This was the Esclangon's way of thanking Yevjevich for his cooperation with French hydraulic institutions. Because of the close relationship between the French and Serbian people during WWI, French intellectuals were very protective of Serbian academicians and academic staff members. For example, Yevjevich's visit with the director of the Hydraulic Engineering School in Grenoble in 1949 confirmed this attitude of French intellectuals. During a lunch, Mr. Esclangon asked Yevjevich how many professional enemies he had in Yugoslavia. He responded all hydraulic engineer Communist Party members were his professional enemies. When Esclangon offered Yevjevich an aperitif before lunch, Yevjevich responded that he didn't drink alcohol. After lunch, Yevjevich was offered cognac, which he didn't drink for the same reason. He also did not drink coffee. Yevjevich was offered a cigarette. His reply was, "I don't smoke". The director asked, "Young fellow, we Frenchmen have a saying: The sum of a person's vices is a constant. What are your vices?" Yevjevich responded: "Let me not answer that question."

21.10. OFFER TO YEVJEVICH TO BE A "PROFESSOR" FOR 300 ENGINEERS AT NEURPIC. In 1950, when Yevjevich accepted the position of professor at Colorado State University, his hydraulics professor from Grenoble, Mr. Pierre Daniel, came to Denver to sell to the US Bureau of Reclamation hydraulic instruments for irrigation (constant levels, constant drawing of flow from canals, etc.). He called Yevjevich by phone and asked to see him at CSU. Once they met, he told Yevjevich of a proposition. University professors have the opportunity to continuously advance in their profession by teaching and doing research. Daniel's 300 engineers, many specialized in hydraulics, didn't have those opportunities. He wanted Yevjevich to come to Grenoble and be a resident professor to those 300 engineers and be responsible for their professional advancement. He offered Yevjevich a salary increase of at least 50%. Yevjevich ended the discussion by pointing out that money was not the only consideration. "Tomorrow, I can become an American, if I want to", Yevjevich concluded, "but in France it might be difficult to become a Frenchman." Yevjevich felt he was either "the little Serb" or "the big American" to the French.
CONTENT: (1) influence of German culture in Bosnia & Herzegovina; (2) The German occupation of Yugoslavia and Yugoslav POW experience, 1941; (3) German Officer interrogating Yugoslav Officers on their points of view on the war; (4) "Benjamin" to Yugoslavia as POW; (5) Post-war Inform Buro countries stopping economic relationship with Yugoslavia and renouncing contracts for hydropower equipment; (6) Establishing cooperation between Colorado State University and the University of Braunschweig in the field of advanced hydrological research; (7) Visiting University of Hannover by invitation, discussing the percentage of college-age people receiving university education in the world; (8) Delivering a lecture on stochastic processes in hydrology at the University of Karlsruhe; (9) Participation in the hydraulic compress in Baden-Baden; (10) Cooperation with Prof. Dr. Erich Plate; (11) Cooperation with the University of Bochum, esp. with Prof. Gert Schulz.
22.1. INFLUENCE OF GERMAN CULTURE IN BOSNIA & HERZEGOVINA. Yevjevich's contact with the German culture started in Bosnia before WWII. That was especially reflected in his high school education, which included five years of German language studies. However, French dominated in those days and Yevjevich studied French for seven years in high school. Later, Yevjevich continued to be influenced by German culture at the Civil Engineering Faculty of the University of Belgrade, because most of the professors were German-educated engineers, teaching German-type of engineering technology.

22.2. GERMAN OCCUPATION OF YUGOSLAVIA AND YEVJEVICH AS P.O.W., 1941. When Yugoslavia refused to accept Hitler's demands on Yugoslavia's Government, Germany invaded Yugoslavia in April, 1941. Coming from Bulgaria, the Germans cut off the roads to Greece, so the Yugoslav Army was unable to join the British Army in Greece. The Germans imprisoned many Serb Officers, including Reserve Officers like Yevjevich. He was transferred from a collection camp near Skopje, Macedonia to Dragoman, Bulgaria. From there, the POW Officers were transported in cattle trains to Germany.

22.3. GERMAN OFFICER INTERROGATING YUGOSLAV OFFICERS. While in Dragoman, Bulgaria, a German Officer interrogated Serbian POWs. He wanted to know why Yugoslavia had refused to cooperate with Hitler. When Yevjevich's turn came, he asked the German Officer to guarantee that regardless of the Yugoslav Officers' point of view, there must not be any retaliation against them. The German Officer gave his word of honor that there wouldn't be any repercussions. Yevjevich then answered the German's question: "There is no one Office POW here who is not convinced that Germany will lose the war. We estimate that we will be POW for six to seven years if the US doesn't join the war. If the US does enter, we expect to be in the camps for two to three years." The German did not react, except that he got red in the face. Yevjevich was right. After the US joined the war on December 7th of that same year, Yevjevich spent another two and a half years in POW camp.

22.4. "BENEFITS" TO YEVJEVICH AS P.O.W. Once Yevjevich had adjusted to POW life, he decided to use his time as a POW to his best advantage. According to the Geneva Convention, Officer POWs do not have to work for the enemy. In addition, they have a salary in the form of camp bonds, replacing German Marks. Yevjevich used that money to buy every possible German book on his profession, as well as books on foreign languages. Later, in Italy, when he left the POW camps, he could read literature in seven languages. By that time, he had studied thousands of pages of professional literature.

22.5. POST-WAR INFORM BURO COUNTRIES. When Stalin designed the Inform Buro to discipline Tito, all East European Inform Buro countries denounced all contracts with Yugoslavia, so the Yugoslav Ministry of Electricity sent a delegation to Western countries to replace those contracts. Yevjevich was one of the delegation members. They visited all West European countries that produced equipment for hydroelectric power plants. Yevjevich's second German visit was in 1949, including a trip to Siemens in Erlangen, Bavaria, which was a difficult experience because his wounds of war were still in the process of healing. He didn't have any more contact with German professionals or companies until later, when he was established in the US.

22.6. COOPERATION BETWEEN CSU AND THE UNIVERSITY OF BRAUNSCHWEIG. Dr. Manjak, professor of hydrology at the Braunschweig University, invited Yevjevich to lecture in advanced hydrology. That was the beginning of a continuous exchange of information and literature between the two universities.

22.7. VISITING THE UNIVERSITY OF HANNOVER. In the early 1970s, a professional discussion on the percentage of people of college age receiving university education in the world took place in Germany. Yevjevich estimated that in the US, it was around 20-25%, while in Germany it was 8-8%. He used to tell frien that if you walk down Mainstreet USA, there is a 25% probability young people of college age you see are college students or college graduates.
22.8. LECTURING AT THE UNIVERSITY OF KARLSRUHE. Prof. Erich Plate spent some time at CSU as a hydrology professor. He returned to Germany and invited Yevjevich to give a lecture on stochastic processes in hydrology, in German. Yevjevich had not tested his German language skills before. He discovered that it isn't easy to retain language skills for a long time. If a language is not spoken, words begin to disappear and the vocabulary shrinks. Prof. Plate understood that, since he had a similar experience. Nevertheless, Yevjevich delivered the lecture in German.

22.9. HYDRAULIC CONGRESS IN BADEN-BADEN. The congress was an occasion for Yevjevich to assess German research in hydraulics and hydrology. He was impressed to what extent a defeated and divided Germany could sponsor large research projects at universities. However, they spent much more money on increasing professors' salaries in order to top US salaries, so as to attract German immigrant professors back to Germany. This was a very successful operation. For instance, Yevjevich is personally familiar with Mr. Plate's case, whose salary is much higher than it would be at CSU. When Yugoslavia considered a similar move and asked Yevjevich to be a member of an advisory committee on this issue, he turned it down because the Yugoslavs had not provided enough incentive for the most successful professionals to return.

22.10. COOPERATION WITH PROF. DR. ERICH PLATE. The cooperation with Prof. Plate continues to this day. However, since both men are retired, it has been restricted. They both cooperated with the civilian branch of NATO's scientific and environmental program.

22.11. COOPERATION WITH THE UNIVERSITY OF BOCHUM. The cooperation with prof. Gerz Schulz started when he was a professor at the University of Karlsruhe and continued when he became a professor at the University of Bochum. He concentrated on the physical response of small river basins to rainfall input and the use of computer technology applied to this type of research. Yevjevich considered his stochastic approaches to the same environment as Schulz's to be complementary, rather than repetitive.
CONTENTS: (1) First contact with Greek hydraulic engineers on the Vardar River; (2) Planning and discussion of the potential future of the Danube-Morava-Vardar-Aegean Sea navigation route; (3) Greek-Macedonian controversy regarding Lake Dojran; (4) Ideas on joint Greek-Macedonian development of Vardar River water resources; (5) Invitation to Yevjevich to lecture on the Vardar River development at the Thessaloniki Business Club; (6) Participation in an advanced NATO study institute on the Island of Skopelos.
23.1. FIRST CONTACT WITH GREEK HYDRAULIC ENGINEERS. Just before departing from Belgrade to the US, Yevjevich got a letter from engineers from the city of Thessaloniki in which they asked for his study on the development of water resources of the Vardar (Aksios) River basin. Instead of doing this, Yevjevich sent an article on the Vardar River to a Swiss engineering magazine, "Wasser Kraft Und Wasser Wirtschaft", and mailed a copy to the Greek engineers, giving them the authorization to translate and publish it in a Greek engineering journal. After it was published in Greek, the chief of the Yugoslav Water Resources Administration made a fuss about it, saying it was like treason, as if it was a crime to tell your neighbor about your plans for a project involving a common river. Yevjevich always tried to be fair with Yugoslavia’s neighbors who had joint interests in developing water resources projects.

23.2. THE DANUBE-MORAVA-VARDAR-AEGEAN SEA ROUTE. For more than a century, various people have had ideas for the creation of a navigational route connecting the Danube with the Aegean Sea. This will enlarge the Danube navigational system and will connect the various Seas (Aegean, Black, Mediterranean and North) through the European Continent. However, the high watershed between the Morava and Vardar Rivers of about 450 meters would require a large number of navigational locks and reservoirs for supplying water to the navigational route. Also, there isn't enough transport of commercial goods to justify the required investment. Yevjevich found another obstacle when he made a detailed study of the route. At least eight different navigational techniques would be required in order to construct the project in the most economical way. Yevjevich concluded that first the Great Morava should be developed by Serbia and Montenegro. Later, a navigational route could be added. Similarly, Greece and Macedonia should do the same with the Vardar, from Skopje to the Aegean, also later adding a navigational route. Only then would the EU and/or the US, or any international investor, come in to build the central connecting part from Skopje to Thessaloniki, installing navigation locks along the Morava and Vardar.

23.3. LAKE DOJIRAN AND GREEK-MACEDONIAN CONTROVERSY. A drought in the area of Lake Dojran, on the border between Greece and Macedonia, depleted the amount of water in the lake, compounding the problems caused by Greek peasants who overdraw water from the lake for irrigation. Two measures were discussed by the two countries. One, to pump water from the Vardar over the hills between the Vardar and Lake Dojran, which would require excessive energy. Second, to drill many wells in a plain near Lake Dojran and pump groundwater into the lake. According to Yevjevich neither plan is economical. A few years ago he visited Lake Dojran with the Dean of the Civil Engineering Department of the University of Macedonia, Mr. Tancev, and Mr. Radevski, the best Macedonian irrigation engineer. They met with the President of the county bordering the lake. Discussing the two measures, Yevjevich added a third option: The division of the lake in two parts, one which should never be emptied, while the other one may be emptied during periods of drought. In this way, tourism can be preserved, even in times of drought.

23.4. GREEK-MACEDONIAN VARDAR RIVER DEVELOPMENT. The Vardar does not have enough water to irrigate the entire Plain of Thessaloniki during the summer. Irrigation can be accomplished by the accumulation of water in the Vardar River basin in Macedonia (the Traska, Lepenac, Crna and Bregalnica Rivers). Therefore, it makes sense to suggest that the Vardar River basin project should be jointly planned, organized, financed, constructed and operated.

23.5. LECTURE ON VARDAR RIVER DEVELOPMENT. The Thessaloniki Business Club invited Yevjevich to deliver a lecture on how he would treat the big lakes, Prespa and Ohrd, in connection with the Vardar River basin, as well as other river basins adjacent to the lakes. Yevjevich's opinion was that Lake Prespa can be used as a storage capacity for water in the region. He expressed two principles: First, the project should not disrupt the environmental balance of the area, but should permit the pumping of water from the lake for the irrigation of land around the lake. If any diversion of water from the lake becomes permissible, it can be diverted in three major directions toward the sea: Via Albania to the Adriatic Sea; via Greece to the Aegean Sea; via Macedonia (Pelagonia, the Black River and the Vardar) to the Bay of Thessaloniki. All three alternatives have the same energy production. Second, water should be diverted to the direction of the largest area which can be irrigated, which is the Plain of Thessaloniki.

23.6. PARTICIPATION IN ADVANCED NATO STUDY INSTITUTE. The Institute was organized by colleagues from Hungary and Greece. Its aim was to further the cooperation of Balkan countries in water resources development. Yevjevich used this opportunity to present his vision on Balkan cooperation in water area.
CONTENTS: (1) Brief history of Yevjevich's cooperation with three generations of Hungarian scientists; (2) First visit to Hungary and old hydraulic structures still functioning along the Danube River, 1947; (3) Yevjevich's contribution to election of Janos Bogardi, Prof. of Hydraulics at the University of Budapest; (4) Cooperation with Balkan countries on flood control on large rivers, like the Danube, Tissa, Drava, Sava, etc.; (5) NATO environmental conference in Visegrád; (6) Cooperation between George Washington University and Hungarian Water Resources Center (Vituki) on environmental problems; (7) Using liquid animal waste for irrigation of fast-growing timber; (8) Helping Hungarian students to escape from the Russian invasion, 1956.

24.1. COOPERATION WITH THREE GENERATIONS OF HUNGARIAN SCIENTISTS. As a student in Belgrade Yevjevich spent the summer of 1934 working on the construction of the Novi Sad - Subotica highway. It was an opportunity to meet Hungarian hydraulic engineer (Németh, László) who visited Vojvodina several times during the era of levees and dykes building for the protection against floods. The invention of the water vapor machine and the use of timber growth along large rivers for fuel enabled the largest flood control projects to take place in Central Europe. As a result, land was used for intensive agricultural purposes. In the late 1940's Yevjevich visited the projects, meeting with Professors Mosonyi and Bogardi, both Yevjevich's generation. He met the third generation after he had moved to the U.S.

The spelling of names:

- Emil MOSONYI
- György KOVÁCS
- Károly STELCZER
- László ALFÖLDI
- András SZÖLLOS-NAGY
- László SOMLYÓDY
- Ödön STAROSOLSZKY
- Péter BAKONYI
Influence of Leading Hungarian Engineers and Scientists of Water Resources Engineering Know-how on Professional Performance of

Dr. Vujica Yevjevich

Who is Dr. V Yevjevich professionally? Among several titles, he is: Professor Emeritus of Water Resources Engineering of Colorado State University, USA; Foreign Member of Yugoslav Academy of Engineering; Doctor Honoris Causa of the University of Lund, Sweden; Honorary member of the Hungarian Hydrological Society; Honorary President and Honorary member of the Yugoslav Association for Hydrology; and other honorary titles.

Reaching professional competence. It is usually expected, if not required, from a professional person to perform at a reasonable competence. One attains it by practice, usually after the formal schooling. It may be induced by contacts with senior professional persons, and/or by various interchanges with the peers. This type of influence by, as well as co-operation with, the Hungarian colleagues in research covers the period of 1947-2000 (53 years). These contacts started primarily at the international meetings. They were mostly the technical and scientific influences by Hungarian colleagues and the corresponding findings of mutual influences by Dr. Yevjevich. They are presented in this brief, invited review. The influences by the Hungarian colleagues were mainly of technology and water resources science developed at VITUKI and the Technical University of Budapest.

Subjects of mutual interest. Among the most interested subjects of co-operation were: characteristics of the Danube River channel and of the Tisza River channel in their flows through the Pannonian Basin, but mainly in the Pannonian Plain; stochastic approaches and modeling of processes of characteristic channel space/time dependent random variables of rivers; bed load sediment transport; unsteady flow in open channels; investigation and modeling stochastic hydrologic processes; problems and solutions in water pollution control; hydraulic modeling and its numerical computation; water resources planning and operation; etc.

Channels of large rivers. Sediments in which the Danube and Tisza rivers have excavated their channels, and maintained them as such at present, are quite different. They are kept relatively consistent in composition for each of them along the Pannonian Plain. The channel of the Danube is excavated by it in bed sediments. It consists mainly of fine sand. All other sediments, especially the fine suspended sediments, have been either deposited in the Pannonian Sea or taken by the Danube into the Black Sea. The channel of Tisza behaves differently, because it is excavated by erosion in cohesive deposits, and moves mainly in its own sediments. This material once suspended but then deposited and consolidated long before the iron Gata Narrows were cut down to present levels by the Danube. Ones dried out they became cohesive material such as clay. These different environmental materials have created the specific channel characteristics with which professionals responsible for the river regulation works must be well acquainted with and taken into account. In their work Dr. Endrő Németh and Dr. Woldemar Lászlóffy discussed those topics with Dr. Yevjevich on several occasions. They had basically similar views, specially on their implications on channel stability and the techniques how to regulate channels of large rivers.

Sediments. Most of the river sediment problems in Hungary are related to bottom sediment transport of large rivers (Danube, Tisza, Drava), since construction of large storage reservoirs is limited. In Yugoslavia, both the bottom transport (bed load near and at the bottom of a channel) and suspended load (usually covering the entire channel water
flow profile) were important. This is so because of both, the importance of bed load of rivers and the siting of reservoirs. The joint reviews by Dr. János Bogárdi, the author of the classical study and book under the general name "Sedimentation", and Dr. Károly Stelczer, the author of the book on bed load, led them to some cooperation with Yugoslav engineers, including Dr. V. Yevjevich. That interaction and distribution of those two publications worldwide by WRP (Water Resources Publications, publishing firm controlled by Dr. Yevjevich at that time) led to the full recognition of the values of those two studies and books.

**Hydraulics.** Dr. Lászlóffy was innovative in small-head hydraulics, (as a competition with the Dutch specialists in hydraulics, an extreme interpretation), basically related to rivers, floods, droughts. drainage, and irrigation and others small-head differences hydraulics. Dr. Emil Mosonyi may have been the representative of the opposite school of hydraulics, or of the hydraulics of high-head difference. They are either in form of energy losses only, or sum or differences of energy heads and output or input of high-head power plants. Dr. Péter Bakonyi was an avowed authority for these low-head hydraulics concepts. The two books by Dr. E. Mosonyi on low-head and high-head hydroelectric power plants have carried the impact of this concept to its final fields of application. A very ambitious, joint project, related to the above described hydraulic concept, was the three-dimensional free-surface unsteady flow in open channels, sponsored by the Hungarian Academy of Sciences and the U.S. National Science Foundation. Books on hydraulic physical models by J. Ivánszics, book on bed load by Dr. K. Stelczer, book on sedimentation by Dr. J. Bogárdi, and other books, testify on the viability of Hungarian hydraulics.

**Hydrology.** The hydrology was a special source of joint interests. "Subterranean Hydrology" by Dr. György Kovácz, "Surface Water Hydrology" by Dr. Ödön Starosolszky, books on probability, mathematical statistics and stochastic processes in hydrology, by Dr. V. Yevjevich, and many research projects, showed important fields of cooperation. Dr. László Alföldy made many innovations in hydrologic subjects in VITUKI during the period 1985-1990.

**Environment and pollution.** The next area of cooperation were the pollution of waters, protection of environment and planning of water resources development II Central Europe. Under the leadership of Dr. Ödön Starosolszky, Dr. László Sólyom, Dr. András Szabó, Dr. Péter Bakonyi and others, the cooperation in water area between VITUKI and Colorado State University became very productive.

**Defense from floods by levees.** One of the major contributions by Hungarian Water Resources Know-how was the defense from floods by levees in the Pannonian Plain. The just invented water vapor machine enabled pumping water from polders over levees during high floods by using cheap local trees as fuel. The infiltrating water from high river flood levels must be removed before they destroy crops. That success story spread through the Pannonian Plain and may be in other flat terrains along the large rivers within Europe.

**Help in publishing books.** The contribution by Dr. V. Yevjevich in publishing the books in English by Hungarian authors via the publishing company WRP (Water Resources Publications), which he controlled from 1971 to 1990, enabled him to get published many books by Hungarian authors as well as distributing the books in water resources area, published by other publishers.

**Major conclusions.** It is safe to conclude that the post-war II period was a time of the mutually beneficial cooperation between the Hungarian and Yugoslav engineers and scientists, specialists in water resources area and in water related environmental problems.
24.2. OLD HYDRAULIC STRUCTURES ALONG THE DANUBE, 1947. Being aware of the importance of the vapor-timber combination, Yevjevich visited the Danube at the most intensive flood control areas. He was especially familiar with Dr. Bogardi's sediment transport by rivers. In later years, when Yevjevich attended the hydraulics conference in Iowa City, Prof. Hunter Rouse asked him whether he could recommend a specialist in sediment transport to be invited as guest scientist at the University of Iowa, Iowa City. Yevjevich promised to look into the matter and suggested a few names to select from.

24.3. THE ELECTION OF JANOS BOGARDI. When Yevjevich made his next trip to Hungary, he told Bogardi he would recommend him to Rouse as the best candidate for guest scientist (sediment research) at the University of Iowa. The invitation was for one year. Bogardi agreed. Rouse accepted the suggestion and officially invited Bogardi. It seems that the Academy of Sciences at Budapest made a different interpretation of this invitation. They assumed that Iowa would like a year to assess Bogardi's scientific capacity and then extend a permanent position if he performed accordingly. The Academy immediately elected Bogardi as a Member to counter the potential loss of a well-known professor. Bogardi turned down the invitation. In hydraulic circles in Budapest the rumor was that "Yevjevich elected Bogardi as a member of the Academy".

24.4. COOPERATION WITH BALKAN COUNTRIES ON LARGE RIVER FLOOD CONTROL. The consequences of Yevjevich's good relationship with Hungarian hydraulic engineers helped him to organize a Balkan conference on flood control of large rivers, especially the Danube, Tissa, Drava, Sava, etc. This was accepted, regardless of political tensions between Balkan countries at the time.

24.5. NATO ENVIRONMENTAL CONFERENCE. When NATO formulated a topic of interest to both Western (NATO) and Eastern countries, Yevjevich and Starosolsky submitted a proposal for the Advanced Studies Institute, which was approved. The conference was successfully held in Visegrad, Hungary.

24.6. COOPERATION BETWEEN GEORGE WASHINGTON UNIVERSITY AND THE HUNGARIAN WATER RESOURCES CENTER (VITUKI) ON ENVIRONMENTAL PROBLEMS. In 1978, at the age of 65, Yevjevich retired from Colorado State University. He took his on-going research with Vituki to George Washington University. This was easy because such research also existed at GWU. It was a successful enterprise and several publications resulted from it.

24.7. USING LIQUID ANIMAL WASTE FOR IRRIGATION OF FAST-GROWING TIMBER. While in Highlands Ranch, CO., where Yevjevich settled after he retired from GWU in 1987, he watched both successful and unsuccessful applications of environmental protection principles. Irrigation of hilly land created permanent water flows in many draws when attempts to use liquid animal waste as fertilizer failed. The idea of using liquid animal waste to irrigate and fertilize the upper 15cm of land resulted in an overgrowth of weeds. Yevjevich and Starosolsky cooperated on a book about this experiment.

24.8. HELPING HUNGARIAN STUDENTS ESCAPE FROM THE RUSSIAN INVASION, 1956. Yevjevich was very useful to Hungarian students who either escaped from Hungary or didn't return to their country during and after the Russian invasion. Yevjevich felt it was his duty to help because of the intensive cooperation between him and the Hungarian engineers.
CONTENTS: (1) What should be the principles in forming the Hydrology Research Institute of India at Rourkee?; (2) Modeling the storage capacity of the Indus River for flood control; (3) Ganges River and its hydropower development; (4) Characteristics of Brahmaputra River at entering India; (5) Three technologies in building irrigation canals along the Ganges River; (6) Sudden change of river slope due to flood effects; (7) Disposition of sediments due to sudden change of slope; (8) Monsoon forecast; (9) Nature of river basins and treatment for water resources development; (10) Study of monsoon floods and droughts.

25.1. HYDROLOGY INSTITUTE OF INDIA AT ROURKEE. Three criteria may be rational to consider: (1) only basic research, (2) only applied research, and (3) combined basic-applied research in different proportions. After WWII Japan elected mainly applied research until they successfully created a very productive institute. Then they converted it into a basic-applied organization. From the beginning, Indian hydrologists considered designing a basic research institute. When the UN asked Yevjevich what he would propose for the Rourkee institute, he was completely in favor of the Japanese model. A productive Indian institute would generate enough interest for international research and would generate income. Indian hydrologists rejected Yevjevich's proposal but never created their intended basic research institute.
25.2. INDUS RIVER STORAGE CAPACITY FOR FLOOD CONTROL. The three big rivers of the Indian Peninsula, the Indus, Ganges and Brahmaputra, all drain the high Himalayan mountains and they require very large storage capacities for their water resources development and control, especially for flood control. Yevjevich followed developments related to the Indus, which terminates in a desert area. His observations encouraged him to follow the developments of the other two river basins.

25.3. GANGES RIVER HYDROPOWER DEVELOPMENT. To make the best use of water power of the Indus, very large storage capacity was necessary. Yevjevich was instrumental in advocating a very large storage capacity and the corresponding use of the Indus' high flows to fill those capacities.

25.4. BRAHMAPUTRA RIVER. For the Brahmaputra Yevjevich concurred with Dr. K. L. Rao's ideas. Rao, Minister of Power and Water, and Yevjevich designed the concept of how to solve the problem of the sudden breaking of the slope from the mountain area to the plain of the Indian Peninsula. However, the money allocate for the project from the U.S. P.L. 480 fund where taken by Prime Minister Indira Ghandi and used for India's budget deficit. This was regretted by both Rao and Yevjevich because, at the time, it was the only chance to solve the most difficult hydraulic problem. The Brahmaputra continues to haphazardly deposit its sediment in the plain, only aggravating the problem.

25.5. GANGES RIVER IRRIGATION CANALS. The large Ganges River irrigation canals have been constructed in ways using three different technologies in temporal sequence: (1) iron and wood; (2) steel, and (3) modern computer-oriented technology.

25.6. SUDDEN CHANGE OF RIVER SLOPE DUE TO FLOOD EFFECTS. Figure 6 shows the classical problem of the slope break when rivers pass from mountains to plains and deposit their sediments in the plain. In India entire plains are formed that way. The big river floods play a major role in that process. Yevjevich still hopes to find a solution to that problem.

25.7. DISPOSITION OF SEDIMENTS DUE TO SUDDEN CHANGE OF SLOPE. To solve the above problem, way should be found to dispose of big quantities of sediments with the minimum negative consequences. A new element comes into play: the construction of reservoirs in the mountains themselves for hydropower development and other secondary needs for water. Quite likely the combination of these two on-going processes in India will be the most difficult water resources problem in the world to solve, according to Yevjevich.

25.8. MONSOON FORECAST. When a meeting on monsoon forecasting characteristics was scheduled a difference in positions between Yevjevich, who studied stochastic characteristics of monsoons, and Indian meteorologists came about. While the Indians were fully convinced that they could forecast monsoons, Yevjevich challenged them by saying if they could, he would be the first to recommend them for the Nobel price. He still keeps his word, but the Indians have not yet been able to make accurate forecasts.

25.9. RIVER BASINS AND WATER RESOURCES DEVELOPMENT. Following India's independence from British occupation, tremendous activities in the area of water resources development took place in India. However, the necessary studies of the characteristics of their river basins were not conducted, though it could have been very useful.

25.10. STUDY OF MONSOON FLOODS AND DROUGHTS. Instead of trying to forecast variables with too much randomness in processes, the study of the characteristics of these variables should be exhausted. For example, the number of storms and the yield of water per storm determines the characteristics of floods and droughts of monsoons, which may be useful in planning water resources development. The more storms per year, and the higher the yield per storm, the more water per year is available. The fewer storms and the lower the yield per storm, the more droughts per year.

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Figure 6. Tendencies in deposits of large river sediments.
26. INDONESIA

CONTENTS: (1) Invited visit to Water Resources Authority, Jakarta (karst problems); (2) Density mud currents at the lake near Jakarta; (3) Lecture on water resources planning in Jakarta (under karst conditions); (4) Visit to Bandung, lecturing on the most recent advances in hydrology; (5) Java karst problems and solutions; (6) Bali island water resources and influence of religions on solutions; (7) Study of karstified limestone formations of Indonesian islands; (8) Sumatra island water resources.

26.1. JAKARTA WATER RESOURCES AUTHORITY AND KARST PROBLEMS. The major reasons for the Indonesian WRA to invite Yevjevich were: (1) water resources planning in karst formation, and (2) most advanced hydrology research accomplishments in the world. Yevjevich responded to the invitation by suggesting two lectures be given, one on water resources planning in Jakarta, which was a result of his experience with karst problems and water resources development in Yugoslavia, and the other the advancement in stochastic and physical hydrology, which was based on Yevjevich's experience at Colorado State University. The lectures were given at the Indonesian Water Resources Authority in Jakarta. However, karst studies are so superficial that one cannot tell that there is an Indonesian approach to the specific limestone karst of Indonesia.

26.2. DENSITY MUD CURRENTS AT THE LAKE NEAR JAKARTA. Yevjevich was very pleasantly surprised when he visited the lake close to Jakarta, where he saw green water on the lake surface but when he looked at the canal of the release water, it was as muddy as it could be – brown water. Credit should be given to Nauplie and other French organizations for the design of a water turbine at the lowest position, which catches the mud current. It seems that the often change of that turbine due to erosion by fine sand is a small price to pay for such a successful accomplishment.
26.3. LECTURE ON WATER RESOURCES PLANNING IN JAKARTA. After Yevjevich presented his point of view on how to plan water resources in river basins with karst phenomena, a lively discussion developed between him and the Jakarta Water Resources Planner.

26.4. VISIT TO BANDUNG, LECTURING ON MOST RECENT ADVANCES IN HYDROLOGY. Yevjevich presented advances made in both physical hydrology (especially river basin response to rainfall input) and stochastic processes of rainfall and runoff. He met karst hydrogeologists of Indonesian islands and that connection continued for many years, through visits and correspondence.

26.5. JAVA KARST. In discussions with Indonesian hydraulic engineers, Yevjevich postulated that Java has a specific karst which should be seperately and particularly studied and described.

26.6. BALI WATER RESOURCES. Yevjevich visited Bali twice, once by invitation to Indonesia, the other time while on his way to Perth, Australia. He was curious about the claims that the two major religions of Bali, Islam and Buddhism, have tremendous impact on water resources development. He was not able to detect any such significant influence during a short visit. However, he concluded that tremendous problems exist in the tourist industry and water resources development should take into account the touristic needs for water resources solutions.

26.7. LIMESTONE FORMATION OF INDONESIAN ISLANDS. It is definite that the Indonesian limestone has specific characteristics. Therefore, in an appropriate organization, the task should be given to study and describe limestone formations of Indonesian islands.

26.8. SUMATRA WATER RESOURCES. Yevjevich recommended his Indian Ph.D. advisee, Dr. Mutraja, be given the task of studying water resources of Sumatra. He became one of the chief engineers on that island for several years. However, he passed away several years ago and his work was delegated to others.
27. IRAN

27.1. IRANIAN GRADUATE STUDENTS AT COLORADO STATE UNIVERSITY. Relations between Yevjevich and Iranian hydraulic engineers came about as a result of his work at CSU. He never planned to visit Iran since his Yugoslav colleagues took on the job of visiting and working with Iran from time to time.

27.2. IRANIAN PROFESSIONALS IN WASHINGTON, D.C. During Yevjevich's duties in D.C., 1979-1987, he had many contacts with Iranian professors visiting D.C. He was invited to the Iranian New Year celebration as a guest of the Minister for Oil under the Shah Government. The fall of the Shah regime interrupted Yevjevich's professional relationship with Iranian scientists.
28.1. RELATIONSHIP WITH IRAQI GRADUATE STUDENTS. The major relationship with Iraqi water resources professionals was with graduate students at CSU as well as hydraulic engineers participating at international conferences.

28.2. CONTACTS WITH IRAQI PROFESSIONALS. The major contact with Iraqi hydraulic engineers was in the area of groundwater modeling, observations and solutions of water resources problems. Indirectly, Yevjevich was informed by his Turkish colleagues on the problems of the Euphrates and Tigris Rivers between Turkey, Syria and Iraq.
29. ISRAEL

CONTENTS: (1) Passing the border between Jordan and Israel; (2) Unilateral and multilateral problems and solutions of hydrology; (3) Visiting Haifa University and lecturing on stochastic processes in water area; (4) Discussing groundwater problems at the University of Tel Aviv; (5) Visiting groundwater recharge north of Tel Aviv; (6) Assessing professorial candidates at Universities of Israel; (7) Comparing hiring criteria between CSU and Israeli universities.

29.1. PASSING THE BORDER BETWEEN JORDAN AND ISRAEL. Yevjevich was a UN appointed expert on a mission to assess the problems of the Ghor irrigation canal. The UN officer in charge of the mission was from Israel. Yevjevich was asked to go to Israel to meet the officer. He had to pass the Mandelbaum Gate border crossing between Jordan and Israel. It was quite an experience. Everybody was extremely thoroughly searched. Yevjevich didn't expect a temporary UN employee to be checked like this. He visited the David Hotel in Tel Aviv where he discharged his duty to the officer by informing him on everything he had learned about the canal. Yevjevich had some time to see Israel and was surprised how many Yugoslav Jews could be found in cafes. He found several former Belgrade University students, now Israeli hydraulic engineers. Later, he wasn't surprised meeting them in Canada, after they had immigrated there.

29.2. UNILATERAL AND MULTILATERAL PROBLEMS AND SOLUTIONS OF HYDROLOGY. Being invited to Haifa to meet most of the hydraulic-oriented professors, Yevjevich was not surprised to have a discussion on their research project, namely unilateral and multilateral problems/solutions of water area. That visit taught him to be very attentive in Israel. On every visit he would get new ideas on water area. He holds Israeli water resources professors in high esteem.
29.3. VISITING HAIFA UNIVERSITY AND LECTURING ON STOCHASTIC PROCESSES IN WATER AREA. At the time, it was very attractive for a foreign professor to visit Haifa University. Yevjevich concluded that the cleanest city in the region is Haifa city because every morning the Mayor, a Yugoslav Jew, got up at 6am to clean the city! He would lead his group of cleaners to clean the city. The most interesting aspects of the region were in both Jordan and Israel, including visits to museums, historical religious places, etc.

29.4. DISCUSSING GROUNDWATER PROBLEMS AT THE UNIVERSITY OF TEL AVIV. By some selection of the Israeli Government, the University of Tel Aviv was in charge of basic groundwater research. This was important due to Israel's limited water resources. That visit resulted in an ongoing exchange of information between Colorado State University and the University of Tel Aviv.

29.5. GROUNDWATER RECHARGE NORTH OF TEL AVIV. One of the methods of recharging groundwater is to build a surface reservoir with a porous bottom. Colleagues from the University took Yevjevich to such an area to demonstrate the recharge method. Yevjevich expressed his opinion that, based on his experience, irrigation canals are the best way to recharge groundwater if the recharge is done outside of the irrigation season.

29.6. ASSESSING PROFESSORIAL CANDIDATES AT UNIVERSITIES OF ISRAEL. Several visits to Israel and professional cooperation made Yevjevich one of the professors abroad who assessed Israeli professorial candidates for appointment, promotion or leave of absence.

29.7. COMPARINGHIRING CRITERIA BETWEEN CSU AND ISRAELI UNIVERSITIES. Yevjevich's Israeli colleagues always tried to compare hiring and promoting criteria for professors at Colorado State University and their own universities.
CONTENTS: (1) First visit to Italy by invitation of the Italian Government, 1936; (2) Evoked memories from passing through the Strait of Messina between Sicily and mainland Italy; (3) Prisoner of War in Italy, 1941-1943; (4) Hiding in Rome for 9 months, 1943-1944; (5) Visiting Catania and emerging agreement for cooperation between CSU and University of Catania, Sicily; (6) Visiting Syracuse, Sicily; (7) Visiting Cefalù, Sicily; (8) First organized symposium on hydrology in Erice, Sicily; (9) Planning a special course on operation of water resources in Trapani, Sicily; (10) Lecturing at the Royal Club in Palermo, Sicily; (11) Visiting image area near Bari; (12) Visiting University of Naples; (13) Visiting University of Rome; (14) Visiting Bologna-Parma region; (15) Visiting Trieste; (16) Water resources problems of the Veneto area; (17) Lecturing on water resources operation methods in Trieste; (18) Studying changes in water area in Lombardy; (19) Giving a course on water resources systems operation in Udine; (20) Giving two international courses on hydrology in Padua; (21) Lecture at Milan Polytechnic University; (22) Attending and lecturing at the water resources congress, University of Cagliari, Sardinia; (23) Visiting water resources structure in Southern Sardinia; (24) Election of Yavouch as a member of the Italian Society for the Advancement of Science; (25) Yavouch's opinion on the Basilicata irrigated agricultural concept developed in Italy; (26) Lectures at the University of Catania, 2001.
30.1. FIRST VISIT TO ITALY BY INVITATION OF THE ITALIAN GOVERNMENT, 1938. The Italian Government invited a group of Yugoslav hydraulic engineers in 1938. Yevjevich was an engineer at the Banske technical service of the Macedonian government, and part of the invited group. He was surprised to see the excellent agricultural arrangement of land in northern and central Italy. However, the water resources development in the country and in cities was even more impressive. Yevjevich concluded that any opportunity visit Italy was always worth it. He visited the country copious times between 1938 and 2004.

30.2. EVOKE MEMORIES FROM PASSING THROUGH THE STRAIT OF MESSINA BETWEEN SICILY AND MAINLAND ITALY. In 1953 Yevjevich boarded a cargo ship in Yugoslavia and sailed for the USA via Genova to attend a hydraulics congress in Minneapolis, MN. The first significant impression of the trip was the Strait of Messina. This reminded him of years spent as a POW in Italy and Germany from April 1941 to September 1943 and hiding in Rome for 9 months during the period September 1943 to June 1944.

30.3. PRISONER OF WAR IN ITALY, 1941-1943. This will be the subject of another autobiography.

30.4. HIDING IN ROME FOR 9 MONTHS, 1943-1944. This will be the subject of another autobiography.

30.5. VISITING CATANIA AND ARRANGING AGREEMENT FOR COOPERATION BETWEEN CSU AND UNIVERSITY OF CATANIA, SICILY. During the hydrology symposium held in Warsaw, Poland, Yevjevich, who spoke fluent Italian, met Prof. Emmanuele Guggino from the University of Catania. Later, the gossip among other Italian professors was that Guggino met a foreign professor who was fluent in Italian so they could communicate. Guggino was committed to introducing the most-modern methods of teaching water resources engineering and he invited Yevjevich to the University of Catania to discuss the cooperation between that university and CSU. Italy had an organization in Rome called Fornez, which was helping universities with updating their curricula. A group of Italian representatives came to CSU and negotiated an agreement between them and CSU. Guggino was the Italian group leader, Yevjevich his CSU counterpart. That cooperation lasted some 10 to 15 years. It was beneficial to both parties.

30.6. VISITING SYRACUSE, SICILY. Yevjevich's next Italian trip was to the Greek type city of Syracuse, Sicily. He was highly impressed because the city had a good water resources system.

30.7. VISITING GELA, SICILY. This is the largest Italian and European facility for the conversion of saline water to fresh water. That meant Sicily has areas with very low availability of water. Therefore, there is a priori for water resources projects.

30.8. FIRST ORGANIZED SYMPOSIUM OF HYDROLOGY IN ERICE, SICILY. The next visit was to Erice, about 800 meters above sea level near Trapani, which the Italian Government had made into a tourist attraction. Yevjevich immediately organized the next hydrology symposium in Erice because he had been so positively impressed by it. This decision was very well received. During the following 10 years more symposia were held there, organized by the University of Catania.

30.9. PLANNING A SPECIAL COURSE ON OPERATION OF WATER RESOURCES IN TAORMINA, SICILY. Representatives of CSU, University of Catania and Fornez from Rome met in Taormina and designed a special course on operation of water resources systems to be developed in FL Collins. That course was probably the largest contribution of the three parties combined.

30.10. LECTURING AT THE ROTARI CLUB, PALERMO, SICILY. To satisfy the desire of professors at the University of Palermo, Prof. Guggino organized a lecture at the Rotari Club of Palermo, where Yevjevich exposed his ideas on how to solve Sicily's water resources problems. That was important for Palermo, because one part of the city was receiving water from water tanks transported by trucks. The lecture was well received by a group of about 50 participants and a lively discussion followed. What surprised Yevjevich was that nearly all of them were almost identically dressed. After the lecture one participant told Yevjevich that this was the "flower the Mafia".

30.11. VISITING MURGE AREA NEAR BARI. Yevjevich was again reminded of WWII, this time the worst part of the war that he was in. It will be part of another autobiography.
30.12. VISITING UNIVERSITY OF NAPLES. Yevjevich visited the hydraulics laboratory at the University of Naples and saw the major hydraulics experiments and problem solutions that were taking place there.

30.13. VISITING UNIVERSITY OF ROME. Once again, Yevjevich was reminded of WWII and his friends, who knew him by his pseudonym, "Giovanni".

30.14. VISITING BOLOGNA-FLORENCE REGION. This was probably the most scientific trips of all of Yevjevich's Italy trips because the best Italian scientists were at the Universities of Bologna and Florence.

30.15. VISITING TRIESTE. Yevjevich was reminded of the time when he participated in the transfer of two Italian hydroelectric power plants to the Soča River in Yugoslavia.

30.16. WATER RESOURCES PROBLEMS OF THE VENICE AREA. The surroundings of Venice are full of water resources problems. Pumping water from the deep area near Venice has created subsidence of Venice itself. From that visit on Yevjevich followed all developments in solving these problems.

30.17. LECTURE ON NEW WATER RESOURCES OPERATION METHODS IN RIMINI. When a course on water resources operation was established in Rimini, Yevjevich was invited to give a course to the best specializing Italian students in water resources area.

30.18. STUDYING CHANGES IN WATER AREA IN LOMBARDI. Yevjevich had been familiarized with water resources problems in this area of Northern Italy during WWII. He visited a couple of cities in the area to see how the issue of these problems had been evolving. In the Po River floods had been changing on the average, either increasing or decreasing, and the same happened with low flows. Those changes with negative repercussion could be attributed to the building of reservoirs in the river basin and to the use of sand and grave for construction purposes.

30.19. GIVING A COURSE ON WATER RESOURCES SYSTEMS OPERATION IN URBINO. When graduate water resources studies had been established in Urbino, Yevjevich was invited to deliver a course on the operation of water resources systems.

30.20. GIVING TWO INTERNATIONAL COURSES ON HYDROLOGY IN PADOVA. The UN established several international courses in hydrology around the world, one of which was established in Padova. Twice Yevjevich was invited to deliver an international course in stochastic processes at the University of Padova.

30.21. LECTURE AT MILANO POLYTECHNICAL UNIVERSITY. Yevjevich holds prof. D'Marchi in high esteem. He was a professor of hydraulics in Milan. He wrote the best two-volume book on hydraulics in Italian. At one time, Yevjevich considered translating the book from Italian to English, but could not spare the time.

30.22. ATTENDING AND LECTURING AT THE WATER RESOURCES CONGRESS, UNIVERSITY OF CAGLIARI, SARDINIA. Yevjevich presented a lecture on water resources at the congress in Cagliari. His good friend, Prof. Fasone, was a professor at Cagliari and organized for Yevjevich to see some of the interesting water resources structures in Sardinia.

30.23. VISITING WATER RESOURCES STRUCTURE IN SOUTHERN SARDINIA. Yevjevich was so impressed by these structures in Cagliari that he decided to visit similar structures in the south of the island.

30.24. ELECTION OF YEVJEVICH AS A MEMBER OF THE ITALIAN SOCIETY FOR THE ADVANCEMENT SCIENCE. Prof. Angelini, Director of Electrical Power of Italy, approached Yevjevich in Catania with the idea of eventually discussing the possibility of transferring surplus water and surplus hydropower from the Yugoslav coast to southern Italy. Though Yevjevich was a professor in the USA, he consulted with Yugoslav specialists who had been advocating the same idea. In the meantime, Prof. Angelini suggested that Yevjevich be a member of the Italian Society for the Advancement of Science. Yevjevich was elected.

30.25. YEVJEVICH'S OPINION ON THE BONIFICA INTEGRALE AGRICULTURAL CONCEPT DEVELOPED IN ITALY. During the long days of POW life in Northern Italy during WWII, Yevjevich had a book titled "Bonifica Integrale", which means "General Improvement" of the land for agriculture. He concluded that its ideas were
good for labor-intensive small farming agriculture. The intensive agricultural machinery can not be so easily implemented in the “Bonifica Integrale” concept.

30.26. LECTURES AT THE UNIVERSITY OF CATANIA, 2001. Dr. Giuseppe Rossi, professor of hydraulics at the University of Catania, invited Yevjevich for a week of lectures on hydrology and water resources engineering with the most advanced development. He also prepared a lecture on a very useful water resources engineering subjects, tailored primarily to practicing Sicilian hydraulic engineers. That was one of many cooperative professional activities between Yevjevich and Rossi, since the time Rossi assumed the position previously held by the late Prof. Guggino.
31. JAPAN

CONTENTS: (1) The first serious contact with post-WWII Japanese scientists in Hawaii; (2) Congress on the island of Hokkaido; (3) Symposium in the city of Sapporo; (4) Visiting the atomic power plant on the coast of Sendai; (5) Sleepover in Tokyo and visiting the construction of the University of Tsukuba; (6) Meeting with Prof. Yamamoto; (7) Congress in Kyoto; (8) Japanese visitors at Colorado State University.

31.1. THE FIRST SERIOUS CONTACT WITH POST-WWII JAPANESE SCIENTISTS IN HAWAII. Yevjevich organized the first bilateral US-Japanese symposium in Hawaii, January 1971. The topic was a new concept of systems approach to hydrology. That meeting involved the best scientists of both countries. It can be considered as the real beginning of cooperation between US and Japanese scientists. Selecting Hawaii as the location of meetings is always favorable because of the attraction of Hawaii to the Japanese.

31.2. CONGRESS ON THE ISLAND OF HOKKAIDO. The hydraulics congress was held on the most northern big island of Japan. This was an opportunity to rent a car in Tokyo and drive north.

31.3. SYMPOSIUM IN THE CITY OF SAPPORO. Usually when a congress is held, there are several symposia around it on specific aspects of the congress itself. During that congress, a water resources symposium was held in Sapporo.

31.4. VISITING THE ATOMIC POWER PLANT ON THE COAST OF SENDAI. Yevjevich was invited by a professor to the coastal city of Sendai, where an atomic power plant is located. For him the most interesting aspect of the plant was water supply for the cooling system of the plant, including the special care that prevents the mixing of warmer and colder water. The professor who invited him told him that he has a rare American-type house. Yevjevich confirmed this when he visited the professor and his wife.
31.5. STOPOVER IN TOKYO AND VISITING THE CONSTRUCTION OF THE UNIVERSITY OF TSUKUBA. The best Japanese students who graduate from US universities usually become professors at this university. Dr. Norio Tasse, specializing in drought studies, with an engineering degree under prof. Yamamoto, received his Ph.D. at CSU under Yevjevich's advisiorship. He became professor of geophysics at the University of Tsukuba.

31.6. MEETING WITH PROF. YAMAMOTO. On one of Yevjevich's trips to China, Yevjevich stopped over in Tokyo to get acquainted with prof. Yamamoto and his then-student Tasse. He was invited to a six-person dinner. Yamamoto, Tasse, Yevjevich and a man who was later identified as a secretary of an agency for helping foreign countries, as well as two ladies who entertained the guests. Prof. Tasse later explained why the agency secretary was there. No university professor could pay the bill for dinner, which amounted to $1,200. Hence, the agency footed the bill. This was Yevjevich's first experience with Japanese-style entertainment.

31.7. CONGRESS IN KYOTO. The last time Yevjevich visited Japan he was at a congress in Kyoto. He was impressed by many new developments, especially the high-speed Tokyo-Kyoto train, as well as a wrestlers' song at the beginning of the opening of the symposium. Yevjevich received a tape of the music as a gift.

31.8. JAPANESE VISITORS AT COLORADO STATE UNIVERSITY. Prof. Takeuchi spent a year as a visiting scientist with Yevjevich at CSU. He is from a southern Japanese island. Also, two hydrologists from Hokaido island spent a year with Yevjevich at CSU. Many other Japanese visitors have passed through CSU for shorter time periods and for specific aspects of their hydrological studies.
32. JORDAN

**CONTENTS:** (1) Inspecting the Gor Canal to make it operational; (2) Extraction of minerals from the Dead Sea; (3) Irrigation in East-Central Jordan; (4) Jerusalem; (5) Industrial area; (6) Al 'Aqabah; (7) Gaza.

**32.1. INSPECTING THEGOR CANAL TO MAKE IT OPERATIONAL.** Following the creation of Israel, the UN could not give aid to Israel without also at the same time helping Arab countries. When Israel received aid, Jordan received aid in order to make the Gor Canal operational. The UN gave Yevjevich the task to inspect the canal and do whatever was necessary to make it operational.

**32.2. EXTRACTION OF MINERALS FROM THE DEAD SEA.** Although Israel occupied part of the Dead Sea, it was feasible for Jordan to extract minerals from the mineral-rich Dead Sea. This competition between the two countries continued all the way through the Mid-East crisis.

**32.3. IRRIGATION IN EAST-CENTRAL JORDAN.** Irrigation problems in Jordan were closely related to water use by Israel. Because of the limited quantities of water available in the Mid-East, the tendency among all countries was to insure permanent water supply for irrigation purposes as soon as possible.

**32.4. JERUSALEM.** One of the consequences of the Mid-East war has been the division of Jerusalem into East and West. The question of tourism, induced by tourists visiting Jerusalem, has been a contentious issue between Israel and Jordan for many years.

**32.5. INDUSTRIAL AREA.** Mineral-based industrial production is a critical factor in Middle-East relationships, especially between Israel and Jordan. Every UN expert in water resources working in this area is affected by this economic-political competition. So was Yevjevich. In practical terms, competition has been going on for as long as the Dead Sea has existed.

**32.6. AL 'AQABAH.** This is another competitive area between Israel and Jordan that must be taken into account by any expert working in this region. Again, Yevjevich was influenced by these factors.

**32.7. GAZA.** Similarly, the undecided status of the Gaza Strip had a substantial influence on any UN professional consultant working in that area.
CONTENTS: (1) Beirut; (2) Bekaa; (3) Tripoli; (4) Dam on Litani River; (5) Diversion of the Litani River toward the sea as part of the hydroelectric power plant.

33.1. BEIRUT. Yevjevich's first foreign consultancy took place in Lebanon, particularly in Beirut. There were two reasons for this: (1) Yugoslav firms had several Lebanese water resources construction contracts (the port of Tripoli, the hydroelectric power plant on the Litani River, the Litani Dam, some irrigation in the Bekaa Valley, and water supply projects); (2) Yugoslav experts were among the cheapest to the Lebanese at the time because salaries had been determined by the Yugoslav Government and were below Lebanese average.

33.2. BEKAA. The Bekaa Valley is the most productive agricultural area of Lebanon. Being a Lebanon expert, Yevjevich was also asked to solve many smaller water resources problems in this valley. Yevjevich visited the valley many times as consulting jobs came to him.

33.3. TRIPOLI. This is a military port, but also has an important function as a sea port to the Lebanese economy. Based on his Yugoslav experiences, Yevjevich convinced the Lebanese they should give their hydraulic modeling study of the port to the Avari Laboratory in Belgrade, Yugoslavia. He obligated himself to be the interpreter of the laboratory results. The major problem was the design, construction and safety of the dyke protecting the port.

33.4. DAM ON LITANI RIVER. The construction team of the Litani River Dam was surprised to find karstified limestone in the foundation, which was water pervious. Yevjevich gave advise on how to solve this problem, based on similar experiences in Yugoslavia.

33.5. DIVERSION OF THE LITANI RIVER TOWARD THE SEA AS PART OF THE HYDROELECTRIC POWER PLANT. Drilling the tunnel from the Litani Dam toward the Mediterranean Sea, engineers encountered flowing sand, a problem which an Italian company and a Yugoslav company had to solve. Yevjevich had to help solve this problem as well as learn how to do it.
LIST OF SUBJECTS SELECTED BY PROF. YEVJEVICH AS EXAMPLES OF HIS CONTRIBUTIONS TO WATER RESOURCES DEVELOPMENT OF MACEDONIA.

List of structures, projects, revisions of projects and other works by prof. Yevjevich, which can be considered as his contributions to the development of water resources of Macedonia.

1. Influence of Yevjevich on solutions to Macedonian water resources problems.
2. Conception of the Mavrovo Water Resources System.
3. Design of Vrben HE power plant.
4. Design of Vrutok HE power plant.
5. Irrigation of Polog.
6. Water resources scheme of the Vardar River basin.
7. Solution to water resources problems of the Skopje Plain.
8. Water resources scheme of the Black River basin.
10. Water resources scheme of Bregalnica River.
11. Treska River as the source of regulated water flow.
13. Water resources scheme of the Black Drim River basin.
14. Water resources scheme of the Pčinja River basin.
15. Water resources problems of Lake Dojran.
16. Water resources scheme of the Radika River in conjunction with Mavrovo Water Resources System.

NOTE: Contributions to Macedonia water resources development by prof. Yevjevich have been described in a Serbian-language report of 50 pages and 26 maps/figures. Only the list of topics from that report is described above. The intention is to translate the report into English, time permitting.
CONTENTS: (1) Yevjevich family on vacation in Mazatlan; (2) Visit to the southern area of Baja California; (3) Vacation in Porta Vajarta; (4) Vacation in Acapulco; (5) US-Mexican cultural exchange at El Paso; (6) Visit to a river in Mexico's "Grand Canyon"; (7) New school for professionals in water resources engineering; (8) Visit to Guadalajara, Mexico's second city; (9) Visit to Mexico City, center of Spanish-Mexican culture; (10) Indian Museum in Mexico City.

35.1. YEVJEVICH FAMILY ON VACATION IN MAZATLAN. While at CSU, Yevjevich was looking for a place to spend the vacation with his family. The family selected the city of Mazatlan on Mexico's Pacific Coast. For several years they spent vacations there.

35.2. VISIT TO THE SOUTHERN AREA OF BAJA CALIFORNIA. While on vacation, the Yevjevich family visited Baja California.

35.3. VACATION IN PORTA VAJARTA. The next vacation place, Porta Vajarta, was selected after Yevjevich and his family had become very familiar with Mazatlan.
35.4. VACATION IN ACAPULCO. It is no surprise that the Yevjevich family eventually spent their vacation at Mexico's international tourist attraction.

35.5. US-MEXICAN CULTURAL EXCHANGE AT EL PASO. To understand how the US and Mexican cultures mix, one should go to El Paso and contemplate what each culture gives to the other.

35.6. VISIT TO A RIVER IN MEXICO'S "GRAND CANYON". In the North-East of Mexico there is a river that runs through Mexico's own "Grand Canyon".

35.7. NEW SCHOOL FOR PROFESSIONALS IN WATER RESOURCES ENGINEERING. A congress was organized and held at a school in North-East Mexico and from the program of the congress the program of the school was born. The school turned out to be only for Mexican graduates.

35.8. VISIT TO GUADALAJARA, MEXICO'S SECOND CITY. Soccer enthusiasts love to visit this city as its soccer teams are among the best in the country.

35.9. VISIT TO MEXICO CITY, CENTER OF SPANISH-MEXICAN CULTURE. It's worth spending several days here, visiting the various areas of town, and observing the interaction of European and Native cultures.

35.10. INDIAN MUSEUM IN MEXICO CITY. This is one of the best ethnic museums Yevjevich has seen in the whole world. To get a thorough understanding of Indian culture, one should visit this museum. The very complex relationship between the US and Mexico is but one other subject the museum covers.
CONTENTS: (1) Cooperation with The Netherlands in water resources area; (2) Low head hydraulics; (3) The hydrograph of the Rhine River at its entrance into the North Sea as the indicator of events in the river basin; (4) Practical water resources courses; (5) Application of statistics in hydrology and water resources; (6) International hydrology course; (7) Method of preparing data for water resources development; (8) Probability of failure of dykes; (9) Hydraulic modeling techniques; (10) Water resources planning.

36.1. COOPERATION WITH THE NETHERLANDS IN WATER RESOURCES AREA. During his 14 years as the leading Yugoslav hydraulic engineer (1944-1958), Yevjevich made many efforts to establish cooperation in water resources area.

36.2. LOW HEAD HYDRAULICS. The Yugoslavs learned much about low head hydraulics from the Dutch. Low head could be defined as the small incremental loss of energy in the direction of flow. This would mainly cover agricultural irrigation and drainage areas, as well as coastal areas, namely the interaction between fresh and saline water, with low head changes in the direction of the flow.
36.3. THE HYDROGRAPH OF THE RHINE RIVER AT ITS ENTRANCE INTO THE NORTH SEA AS THE INDICATOR OF EVENTS IN THE RIVER BASIN. Dutch hydraulic engineers succeeded in establishing a standard of measuring the pollution of rivers by measuring the characteristics of the flow of the Rhine at its North Sea entrance. Quantity and quality hydrographs integrate everything that happens in a river basin.

36.4. PRACTICAL WATER RESOURCES COURSES. These practical courses attracted students from many countries, especially from Yugoslavia. They did a good service to solving water resources problems in Europe and in developing countries.

36.5. APPLICATION OF STATISTICS IN HYDROLOGY AND WATER RESOURCES. This specific area was very much cultivated in both The Netherlands and Yugoslavia throughout the post-WWII period. Some Yugoslav specialists lectured in Delft.

36.6. INTERNATIONAL HYDROLOGY COURSES. Among UN-established international hydrology courses, the one in Delft has a preeminent position, in quality, applicability and benefits. Many foreign students from both developed and developing countries have been taking these courses. Yevjevich lectured here twice.

36.7. METHOD OF PREPARING DATA FOR WATER RESOURCES DEVELOPMENT. The method Dutch engineers used for planning data for water resources development served as an example for many hydraulics projects around the world.

36.8. PROBABILITY OF FAILURE OF DYKES. In informal discussions between Yevjevich and Dutch specialists, Yevjevich defended the possibility of seawater overflowing dykes.

36.9. HYDRAULIC MODELING TECHNIQUES. If there is a field in water resources area in which the Dutch dominated the world with complete influence, it was hydraulic modeling techniques. Many foreign hydraulic laboratory engineers were trained in The Netherlands.

36.10. WATER RESOURCES PLANNING. This is another area where Dutch practical approaches and simple solutions have been found to work. Yevjevich was one of those who used them successfully.
CONTENTS: (1) Special climate of the distant country; (2) Visit to New Zealand; (3) Character of sea animals in channel between the Northern and Southern island; (4) Special island animals raised in isolation; (5) Mountain scenery: snow, glaciers and animals; (6) Yugoslav sailors community; (7) Lecture on hydrology at the University of Auckland; (8) New Zealand environment as a copy of Anglia, Britain.

37.1. SPECIAL CLIMATE OF THE DISTANT COUNTRY. New Zealand's position in relation to any other continent, gives it a special climate of a distant country. Yevjevich felt that once you're there, touristic aspects of the country are vigorously imposed on the visitor.

37.2. VISIT TO NEW ZEALAND. Yevjevich only made one trip to NZ, by invitation of a professor from an agricultural college. His lecture on hydrology was his only professional activity there. All other activities were touristic, for which he prepared himself well before leaving the US. He made a stop in Auckland on the way from LA to Sydney, Australia. He was pleasantly surprised to see local animals, which are different than elsewhere.
37.3. CHARACTER OF SEA ANIMALS IN CHANNEL BETWEEN THE NORTHERN AND SOUTHERN ISLANDS. As a tourist, Yevjevich was highly impressed by local species of animals.

37.4. SPECIAL ISLAND ANIMALS RAISED IN ISOLATION. Both sea and land animals differ from the same type of species elsewhere.

37.5. MOUNTAIN SCENERY: SNOW, GLACIERS AND ANIMALS. Special tourist attractions are to be seen only through guided tours on the Southern Island.

37.6. YUGOSLAV SETTLERS COMMUNITY. Yevjevich visited a small community of Dalmatian settlers. They preserved much from the "old country", such as the production of excellent wines.

37.7. LECTURE ON HYDROLOGY AT THE UNIVERSITY OF AUCKLAND. Yevjevich gave a lecture based on lectures from the Anglia Hydrological institution.

37.8. NEW ZEALAND ENVIRONMENT AS A COPY OF ANGLIA, BRITAIN. Before leaving NZ Yevjevich was asked for his opinion on life in the country. He said it was as close a copy of Anglia, Britain as was possible.
CONTENTS: (1) Oslo's water resources development; (2) Norwegian museums; (3) Example of Fjord scenery; (4) Example of Fjord scenery; (5) Assessment of useability of old hydroelectric power equipment.

38.1. OSLO'S WATER RESOURCES DEVELOPMENT. Among Norway's attractions are water resources developments in both small and large communities. It is easier to detect natural aspects of water resources than man-made features. Norway's modern water resources developments are highly influenced by the climate and geophysical aspects of the country. As a representative of a small country, Yevjevich was very well received, as if he was Norwegian. Perhaps it was related to the fact that a good number of Yugoslav POWs had worked in WWII Norway under German occupation. Everything points toward the fact that the Norwegians were very pleased about the POWs' work and their behavior, both during and after WWII.

38.2. NORWEGIAN MUSEUMS. The two aspects of Norwegian Museums are: (1) The way of life and the old culture of the Norwegian people, including the history of the Vikings and related memorabilia; and, (2) The special Museum of Sculptures, a type of open-air museum.

38.3. EXAMPLE 1 OF FJORD SCENERY. The entire west coast of Norway consists of fjords, like multiple necklaces, with good fishing waters. Visiting fjords was a pleasure in many ways.

38.4. EXAMPLE 2 OF FJORD SCENERY. Another type of fjord has been of interest to those concerned with the production of hydroelectric energy. The flow of water into the fjord is influenced by the availability of river water and river head for power production.

38.5. ASSESSMENT OF USEABILITY OF OLD HYDROELECTRIC POWER EQUIPMENT. Norway is the country were the first developments of hydropower were made. Hydropower technology was among those developed here. Yugoslavia sent technicians to find out whether some of Norway's old(er) equipment, replaced by more advanced technology, could be temporarily used for some of Yugoslavia's new hydropower projects. In the end, Yugoslavia did not purchase this equipment.
CONTENTS: (1) Conflict between Muslim Pakistan and Hindu India; (2) Relationship between Pakistan and Afghanistan; (3) Karachi and Calcutta as examples of overpopulation; (4) Cultures as a function of climate; (5) The desert near the sea to the tundra in the mountains; (6) Type of terrain influences the need for, and size of, large water reservoirs; (7) Hydropower of the Indus River requiring very large reservoirs; (8) Marketing Indus hydropower energy requires lots of skill and political acumen; (9) Narcotics trafficking and the relationship among states on the subcontinent; (10) Influence of narcotics on Pakistani family life; (11) Effects of the fast population growth; (12) The future of food production and water resources development; (13) Kashmir and the India-Pakistan relationship.
39.1. CONFLICT BETWEEN MOSLEM PAKISTAN AND HINDU INDIA. The composition of the religious groups on the Indian subcontinent, and the related conflicts, is similar to that of other places in the world where people fight for supremacy. After the British were forced out of India, the resulting division between India and Pakistan has been an on-going, unresolved problem. It was not possible to get all Indians into India and all Pakistanis into Pakistan, so, a large number of Moslems live in India and a large number of Hindus live in Pakistan. Everything on the subcontinent is a function of this conflict. However, with the help of the U.N. and others a negotiated peace exists between the two countries. Of interest is how the historical conflict influences water resources developments. With the help of other countries, both India and Pakistan have been able to feed their people.

39.2. RELATIONSHIP BETWEEN PAKISTAN AND AFGHANISTAN. The conflict has pushed the relationship between Pakistan and Afghanistan much closer, both countries being very anti-India. But, that relationship is not as stable as it seems on the surface. It is primarily based on the application of the principle “Your enemy’s enemy is your friend”. All three countries have so many minorities that they will always have internal political problems. A military solution is usually the way these countries try to handle such problems. Each of these conflicts can evolve in World War Three. Needless to say, all this has a tremendous impact on water resources development and cannot be neglected when planning water resources development.

39.3. KARACHI AND CALCUTTA AS EXAMPLES OF OVERPOPULATION. One of the biggest problems in the world is the overpopulation of many large cities. Most of the large cities on the subcontinent have been overpopulated. Karachi and Calcutta are two of the most evident examples of this phenomenon. One evening in Calcutta, when Yevjevich was there on a U.N. mission, he stepped over hundreds of bodies as he walked down sidewalks, a horrendous image that has always stayed with him. Similarly, in Karachi such scenes are more the norm than the exception.

39.4. CULTURES AS A FUNCTION OF CLIMATE FROM THE DESERT NEAR THE SEA TO THE TUNDRA IN THE MOUNTAINS. The various types of culture can be classified according to the influence of the climate. On the subcontinent most often the climate closest to the sea is of the desert type. The cloudy climate in the mountains is of the tundra type. One is amazed to see how narrowly related culture and climate are in this part of the world. This also influences the character of the population.

39.5. TYPE OF TERRAIN INFLUENCES THE NEED FOR, AND SIZE OF, LARGE WATER RESERVOIRS. The climate and the need for large water reservoirs for water resources development are related. On the subcontinent one can distinguish three main areas of terrain: (1) the plains; (2) hilly terrain; and, (3) high mountains. Often, each of the three is settled by homogenous religious groups. All three need large reservoirs for water resources development. This character of water resources development cannot be changed.

39.6. HYDROPOWER OF THE INDUS RIVER REQUIRING VERY LARGE RESERVOIRS. Of the subcontinent’s three large rivers, the Indus, Ganges and Brahmaputra, the first dam was built on the Indus in Pakistan, but with the largest area of the river basin in India. The design of the reservoir was done in such a way that the two countries could both benefit from the dam.

39.7. MARKETING INDUS HYDROPOWER ENERGY REQUIRES LOTS OF SKILL AND POLITICAL ACUMEN. Yevjevich followed the process of developing hydropower and water for irrigation on the Indus River with large reservoirs and how political pressure forced specialists in both countries to behave and to perform.

39.8. NARCOTICS TRAFFICKING AND THE RELATIONSHIP AMONG STATES ON THE SUBCONTINENT. One of the very delicate problems of the entire area is the drug trade. Nearly all the states in the region are involved in this illegal business. Clandestine organizations thrive in most of these nations. Regardless of everything negative and the tremendous investments required to run this business, nearly every state has succeeded in producing enough food for the hundreds upon hundreds of millions of people that live there. The task is to produce enough food for the projected number of people that will live here by the end of the 21st century. For example, in China, where the Three Gorges Project is being build, the largest hydropower project in the world (20,000 MW), the objective is to produce enough electrical power so that reservoir water can be pumped and transported over a distance of some 2,000 km to irrigation projects, which should feed China’s population by the end of the 21st century. In many countries the task of economical planning has shifted from the present to the future. Instead of being late, countries are trying to be on time.
39.9. INFLUENCE OF NARCOTICS ON PAKISTANI FAMILY LIFE. It is easier to fight the narcotics industry in a country where family life is open, but it is much more difficult when it is closed, like in some Moslem countries, such as Pakistan.

39.10. EFFECTS OF THE FAST POPULATION GROWTH. While nationalistic elements try to induce people to procreate, so as to increase national power, closed-type families behave in quite different ways. It is easy to hide narcotics trafficking and many other negative social activities in large populations.

39.11. THE FUTURE OF FOOD PRODUCTION AND WATER RESOURCES DEVELOPMENT. All of the above means that there will be much more pressure on water resources development to satisfy the growing demands of population pressure on countries.

39.12. KASHMIR AND THE INDIA-PAKISTAN RELATIONSHIP. One can bet that the cat-and-mouse game between India and Pakistan can lead to a real war between the two, much more serious than past "skirmishes", which would have a very serious impact on water resources development.
CONTENTS: (1) The lower section of the Parana River; (2) Forecast of Parana flow; (3) Different interests in the Parana River between Brazil and Paraguay; (4) Whether or not to dry out large swamps in the Parana River basin; (5) Contract between Brazil and Paraguay for hydropower of the Parana River; (6) Educating specialists from Paraguay on the running of the power plant.

40.1. THE LOWER SECTION OF THE PARANA RIVER. Paraguay occupies the lower part of the Parana River. By all international criteria hydroelectric power of HE Itaipu is to be equally divided by Brazil and Paraguay. That principle seems to be applied to the largest HE power plant in the world (12 million kW). It seems this principle was contractually implemented. Also, Paraguay could not use 50% of hydropower and couldn’t sustain the loan payment. Brazil took over all available power, financially compensating Paraguay for that take-over.

40.2. FORECAST OF PARANA FLOW. The tremendous power of HE Itaipu requires flow forecasts for the best use of power. As the level fluctuation of different water storage capacities in the basin (large swamps) can be measured, and the state of water accumulation in the basin can be computed, a partial flow forecast of the Parana at the dam site can be forecast.

40.3. DIFFERENT INTERESTS IN THE PARANA RIVER BETWEEN BRAZIL AND PARAGUAY. The level of interest in the powerplant Itaipu is not the same in Paraguay as it is in Brazil. There is a different interest in production. Brazil is interested in every power production to be fully transferred to the east, while Paraguay has a small interest in production.

40.4. WHETHER OR NOT TO DRY OUT LARGE SWAMPS IN THE PARANA RIVER BASIN. It is very pertinent to ask whether the drying out of swamps would adversely affect the annual production output of the hydropower plant Itaipu.

40.5. CONTRACT BETWEEN BRAZIL AND PARAGUAY FOR HYDROPOWER OF THE PARANA RIVER. According to many specialists, the contract between Brazil and Paraguay is more advantageous to Paraguay than to Brazil. However, the small quantity of power that Brazil practically gives to Paraguay doesn’t cause the Brazilians much trouble.

40.6. EDUCATING SPECIALISTS FROM PARAGUAY ON THE RUNNING OF THE POWER PLANT. To meet its contractual obligation, Paraguay must educate its professionals. Brazil assists Paraguay in this matter free of charge. Yevjevich was approached by some young people from Paraguay to oversee their Master’s Degree and Ph.D. studies. This happened after Yevjevich retired from Colorado State University.
CONTENTS: (1) Lima, Cusco, Machu-Pichu; (2) Impression of first visit to Peru; (3) Impact of graduate students at CSU on professors consulting in Latin America; (4) Students like Jose Salas; (5) Course in hydrology on water resources at the Ministry of Public Works in Lima; (6) Salas' work at Colorado State University; (7) Communication problem in the Andes Mountains; (8) Critical elevation at Cusco; (9) Copper as the major mineral in the Andes Mountains; (10) International barrier at an elevation of 3,500 meters; (11) Multi-purpose tunnels in the Andes Mountains: minerals, transportation, water resources development; (12) The Amazon region.

41.1. LIMA, CUSCO, MACHU-PICchu. Yevjevich selected Peru as the Latin American country where he first started consultations in South America. Visiting Lima, Cusco and Machu-Pichu, he became familiar with the history of the Incas. Giving assistance to Peruvian students, he deepened his relationship with, and understanding of, Peru.

41.2. IMPRESSION OF FIRST VISIT TO PERU. His impression of the Inca culture and the way the Incas dealt with water resources problems was similar to that of some European peoples living in mountainous areas. In order to familiarize oneself with Inca technology, one has to understand the type of problems they faced and how they solved them in Cusco. For example, the way dry masonry was used in constructions, meaning how stones were fitted into a dry wall with a minimum of space between the stones, and without using mortar.

41.3. IMPACT OF GRADUATE STUDENTS AT CSU ON PROFESSORS CONSULTING IN LATIN AMERICA. Peruvian graduate students at CSU brought with them some of the engineering technology used by the Incas thousands of years. But the influence of that experience to CSU professors was limited.

41.4. STUDENTS LIKE JOSE SALAS. Jose Salas, as an example of Peruvian students, went back and forth between Peru and the USA until he succeeded to convince the Ministry of Public Works in Lima to establish course in hydrology and water resources development at the Ministry.

41.5. COURSE IN HYDROLOGY ON WATER RESOURCES AT THE MINISTRY OF PUBLIC WORKS IN LIMA. Yevjevich and Salas delivered a course in Lima under the auspices of the Ministry.

41.6. SALAS' WORK AT COLORADO STATE UNIVERSITY. Salas became a regular assistant professor, working on different research projects, first under Yevjevich, then independently, developing his own area of research.

41.7. COMMUNICATION PROBLEM IN THE ANDES MOUNTAINS. Salas faced the same problem as all European experts in Latin America do, namely, the connection between the eastern and western slopes of the Andes. It is very hard to make the east-west connection because of the required length of the tunnels.
41.8. CRITICAL ELEVATION AT CUSCO. Tunnel elevation must be at an altitude that permits normal breathing. However, in the Andes, the elevation requires very long tunnels. This is extremely difficult to construct and maintain.

41.9. COPPER AS THE MAJOR MINERAL IN THE ANDES MOUNTAINS. It also seems that mineral content of copper is the deciding factor in the decision on where the tunnels would be built, in order to exploit that ore. The best conditions for exploiting copper may well determine the place where the connection between the eastern and western slope may exist.

41.10. INTERNATIONAL BARRIER AT AN ELEVATION OF 3,500 METERS. It seems that the critical elevation is approximately at Cusco, a city at an elevation of 3,500 meters.

41.11. MULTI-PURPOSE TUNNELS IN THE ANDES MOUNTAINS: MINERALS, TRANSPORTATION, WATER RESOURCES DEVELOPMENT. Multi-purpose tunnels would be the solution to communication problems in the Andes. Yevjevich and his students made studies on the building of tunnels in the Andes, including the development of the eastern side of the mountains for economic development in Peru. Due to big differences in climate on each side of the Andes, two different economic models would be developed, each one fitting its own climate.

41.12. THE AMAZON REGION. Each Latin American state which has territories on both sides of the Andes is eager to develop the Amazon area for the production of food and the exploitation of minerals. Peru falls into this category.
42. POLAND

CONTENTS: (1) Water resources activities in Krakow; (2) Water resources in the Poznan area; (3) Water resources in Warsaw; (4) Water resources in Gdansk.

42.1. WATER RESOURCES ACTIVITIES IN KRAKOW. Yevjevich stopped in Poland while on a trip to the USSR. At the Warsaw airport, he was met by the rector of the University of Krakow, who just got his Ph.D. in Belgrade, Yugoslavia. He tried to demonstrate his contributions to water resources development (to Yevjevich through his doctoral thesis). In Krakow Yevjevich met with both engineers who were Communist Party members as well as those who were not (underground anti-Communist Nationalists). He also met with Dr. Kachmarc, young member of the Polish Academy of Sciences. With his colleagues he was planning to create an international research institute in Luxemburg, Austria, which he did. The institute was financed by private donations and usually selected a topic of importance to the donating country. When Yevjevich joined the institute for a short time, he found something interesting: Most of the participating scientists were after the N Price, especially the well-known statisticians.

42.2. WATER RESOURCES IN THE POZNAN AREA. The study of water resources in this area revealed a specifically Polish distribution of water and water power. The area is typical for the Polish problem of water pollution.

42.3. WATER RESOURCES IN WARSAW. The biggest foreign interest in Polish activities related to water pollution was the Vistula River, which flows through Warsaw and goes into the Baltic Sea.

42.4. WATER RESOURCES IN GDANSK. The best Polish specialists in water area were concentrated are the port city of Gdansk, which at one time was part of Germany.
CONTENTS: (1) Historical monuments, including the King's Palace; (2) Natural beauty in the north; (3) Tagus River; (4) Hotels along the Atlantic Ocean used for international conferences; (5) Faro beach in the south; (6) Soccer and sports competition.

43.1. HISTORICAL MONUMENTS, INCLUDING THE KING'S PALACE. Among Portuguese historical monuments it is the King's Palace that attracts tourists. The name "Portugal" seems to come from the words "Porto di Galli", meaning "the port of the Celts". Being a small seagoing country, Portugal created its own colonies and its own way of running them. One can use Portuguese colonies to study and understand the entire Western colonial system. In China, Yevjevich always used translators from the Portuguese colony of Macao. One of Portugal's biggest accomplishments was the creation of Brazil, making the Portuguese one of the significant languages in the world.

43.2. NATURAL BEAUTY IN THE NORTH. The Galician part of Portugal is very well known for its natural and man-made beauty. Yevjevich never visited that part of the country, but heard about it from Portuguese who worshipped the region.

43.3. TAGUS RIVER. This place is an interesting area for excursions. However, the river also plays an important function in water resources planning of its basin.

43.4. HOTELS ALONG THE ATLANTIC OCEAN USED FOR INTERNATIONAL CONFERENCES. During one conference, Yevjevich found out about an excellent Portuguese laboratory that investigated safety aspects of civil engineering structures. He discussed structural problems of dams with the director of the laboratory. The director naively said to Yevjevich, "Though you are a Communist, you look the same as us". Yevjevich replied, "You would look the same as us if you would have to be a member of a political party like the one that was imposed on us". From that moment on, some of the important investigations related to safety of power plants and other such structures in Yugoslavia were done in Portugal.

43.5. FARO BEACH IN THE SOUTH. Although this beach is on the Atlantic and not on the Mediterranean, it may be considered as one of the nicest recreation areas in the West.

43.6. SOCCER AND SPORTS COMPETITION. Being part of the Iberic Peninsula, Portugal has been caught into soccer competition. The country has been successful in maintaining a good position, like Spain and France. Several large lakes have been made for the purpose of water sports (training, competition, etc.).
44. RUMANIA

CONTENTS:
(1) HE Iron Gate I;
(2) HE Iron Gate II;
(3) Upstream deposits;
(4) Lack of fish ladders on dams of Iron Gates;
(5) Rumanian scientists at NATO's Advanced Studies Institutes.

44.1. H.E. IRON GATE 1. This hydroelectric power plant on the Danube River is jointly owned by Rumania and Serbia & Montenegro. The entire right bank is in Serbia, while only the lower part of the left bank is in Rumania. Therefore, about 65% is in Serbia, 35% in Rumania. The Yugoslav commission which negotiated with its Rumanian counterpart reached this agreement: (1) To divide hydropower 50-50, because the Rumanians practically bought all of the Serbian rights for most of the left bank in Serbia; (2) The upper part of the lake created by the Iron Gate Dam is the place where the coarse sediment (gravel and sand) deposits. This deposit means the level of the lake rises, flooding the land around it. The Rumanians financially compensated the Yugoslavs for this. When Yevjevich was approached to become the member of the Yugoslav commission, the two decisions had already been made. Not being a Communist Party member, he was afraid to be held accountable for decisions he never made. So, he declined to join the commission. This was the right move for someone who did not participate in the decision making process. Sooner or later, the consequences of the commission's decision will be highly taxing on Serbia. Yevjevich also didn't accept to be one of the designers of the hydropower plant as he was already committed to designing other hydropower plants in Yugoslavia.

44.2. H.E. IRON GATE 2. This gate is immediately downstream of the first gate. The owners of the right bank power rights are Serbia and Bulgaria, while the left bank in entirely in Rumania. Both power plants have been operational for many years.

44.3. UPSTREAM DEPOSITS. The coarse sediment of the Danube (0.1mm and up) is being deposited upstream of the two gates. To move that material downstream, the downstream operational levels of the reservoirs have to be decreased, which the Rumanians have been opposing.

44.4. LACK OF FISH LADDERS ON DAMS OF IRON GATES. Two of the largest species of fish in the Danube have disappeared because they cannot pass the two gates. No fish ladders have ever been built.

44.5. RUMANIAN SCIENTISTS AT NATO'S ADVANCED STUDIES INSTITUTE. Rumanian leaders carefully controlled their scientists, monitoring their connections to other scientists from non-Communist countries. This is probably the reason why Yevjevich did not visit Rumania prior to October 2003. He was invited to address the Serbian Congress on Large Dams held in Kladovo, Serbia, close to the Iron Gate I dam. He made an excursion to Rumania, where he met with Rumanian engineers. For years, Yevjevich had used 120 years of measurements and observations of the Danube at the Rumanian station of Orsava. When NATO's civilian institute organized conferences, Yevjevich was a director and major contributor to some of those conferences on several occasions. Two Rumanian female hydrological scientists from the Hydrological Institute at Bucharest applied to attend NATO's program. Yevjevich arranged for them to be accepted. That was his only coordination with Rumanian engineers in his career.
CONTENTS: (1) First contacts with Russian diplomats and military Officers; (2) Second contact with Russia in Belgrade; (3) Leningrad Hydraulic Symposium; (4) Visit to summer vacation city of Russian Patriarchs; (5) The Volga; (6) Siberia; (7) Black Sea; (8) Volgograd; (9) Georgia; (10) Tbilisi.
45.1. **FIRST CONTACTS WITH RUSSIAN DIPLOMATS AND MILITARY OFFICERS.** As a consultant with the Ministry of Public Works, Yevjevich came into contact with Russian officials, mainly diplomats and military officers. When Russia offered a number of Ph.D. assistantships at Russian universities, Yevjevich's name was on a list of candidates. Since he was not a Yugoslav Communist Party member, he was replaced on the list by Dragan Carić, Vice President of the Ministry of Public Works in Croatia, and Communist Party member. Yevjevich was glad that he wasn't forced to go to Russia, since the Russians put a good deal of pressure on such people to become their informants upon the return to the country of origin. When Stalin and Tito split, Carić came back to Yugoslavia from Russia. However, he did not declare that he was hired by the Russians to be their informer. Instead, his friend, who was a UN employee in New York, offered him a position in Pakistan, where some German experts had already been working under a UN contract. Ironically, the information on Carić's whereabouts came to the UN employee from Yevjevich. Carić never returned to Yugoslavia but immigrated to Brazil with the group of Germans. Several years later, when Yevjevich was invited to Brazil as a consultant, he met Carić by chance at a Sao Paulo Hydraulic Laboratory. On Carić's question about what the rumors are about his leaving Yugoslavia, Yevjevich told him the truth, which Carić accepted without comments.

45.2. **SECOND CONTACT WITH RUSSIANS IN BELGRADE.** Yevjevich was an advisor in the Ministry of Public Works, Water Resources Division. One day, two Russian military officers, hydrologists by profession, came to the Ministry, asking for information about the Danube River. They explained their task was to forecast possible flow conditions of the Danube. The Russian troops were about to cross the Danube at Budapest, Bratislava and Vienna. As Yevjevich was well informed about the availability of hydrological data on the Danube, the Minister appointed him as the contact person on this issue. For several days they worked on all points of the Danube where the Russians thought the crossings might take place. When they finished the job, a Russian Officer invited Yevjevich to a bar that served the strongest drinks in town. After a couple of glasses, Yevjevich passed out, only to find himself asleep in a Russian barracks near Belgrade the next morning. That was the first time he got drunk.

45.3. **LENINGRAD HYDRAULIC SYMPOSIUM.** The next contact with Russian professionals was when the symposium on hydraulics took place in Leningrad. That was the first real contact with a clear objective. It consisted of a week of conferences in Leningrad and 10 days of post-conference excursions. That meeting showed the Russian and Westem countries were on about the same level in hydraulics. The post-conference excursion took Yevjevich to Moscow, the Volga River, Black Sea ports, states in the Caucasus Mountains (Armenia, Chechnia, Georgia) and Lake Seven. The purpose of the visit to the lake was to be briefed on the result of cloud seeding by iodine, to increase rainfall over the lake's river basin.

45.4. **VISIT TO SUMMER VACATION CITY OF RUSSIAN PATRIARCHS.** During a Hydraulics Congress in Moscow, the Russians permitted the participants to visit Zagorsk, the central of the Russian Orthodox Church during the summer. Yevjevich joined an Italian group that went to see the summer palace of the Russian Patriarchs. The Italians showed Yevjevich that only elderly people went to church in Russia because the Communist Party did not want young people to attend religious services. The Orthodox Church had retreated into old forms of worship. Yevjevich also visited various places of interest related to water resources development in the greater Moscow area.

45.5. **THE VOLGA.** Most of Yevjevich's Russia visits were to international symposia. Such a meeting happened on a Russian ship on the Volga River. After the congress, Yevjevich took part in a tour of Russia, going down the Volga to the Ukraine, the Black Sea and other places in southern Russia. Of special interest was a visit to Armenia and Georgia. One such visit was to Tbilisi, especially one of the city's churches. Using the post-congress tours, Yevjevich was able to familiarize himself with many Russian water resources developments. One of Russia's biggest hydrometric experiments that resulted in failure in this region was cloud seeding by iodine.

45.6. **SIBERIA.** Yevjevich never visited any place in Siberia. However, he corresponded with Siberian hydrologists when they undertook a large study of characteristics of annual flows of Siberian rivers. According the hydrologists, Siberian annual precipitation had a negative first autocorrelation coefficient, while Europe had a small positive first autocorrelation coefficient. Using several hundred river gauging stations, Yevjevich demonstrated that European-Russian rivers had a significant positive auto-correlation coefficient, 001 for annual precipitation and 020 for annual runoff. This issue of positive correlation still has to be proven true or false. In 1954, when Yevjevich organized a UN conference on how to interpret this correlation coefficient, the Russian academic Kritsky came to Bankok for the conference and defended the Russian interpretation. But the Russ
have often quoted Yevjevich, mentioning he is a Serb in America who holds the above-mentioned position.

45.7. BLACK SEA. The Russians have been interested in Black Sea navigation, as well as navigation routes through Europe using the Danube and Rhine rivers. Large military ports on the Black Sea indicate both Russia and Ukraine are interested in navigational routes from the Black Sea through the Mediterranean Sea to the Atlantic Ocean.

45.8. VOLGOGRAD. During WWII the battle of Stalingrad (Volgograd) was the decisive battle and turning point of the war. The navigational route along the Volga played an important role in the defeat of Hitler's Fascist Germany.

45.9. GEORGIA. The behavior of the Georgians during WWII was critical. The Germans tried to make all non-Russians rebel against Communism. Yevjevich visited Georgia, where he attended a church service. Not only old people but also younger generations were present. This was one of Georgia's ways of fighting Communism after WWII.

45.10. TBILISI. The beauty of the Caucasus mountains, as well as water resources developments, were overshadowed by the beauty of Tbilisi.
46. SERBIA and MONTENEGRO

LIST OF 24 SUBJECTS, SELECTED BY PROF. YEVJEVICH AS EXAMPLES OF HIS CONTRIBUTIONS TO WATER RESOURCES DEVELOPMENT OF SERBIA & MONTENEGRO.

List of structures, projects, studies, revisions of projects and other works by prof. Yevjevich, which can be considered as his contributions to the development of water resources of Serbia & Montenegro.

1. Yevjevich's role in water resources development of Serbia/Yugoslavia.
3. Three geophysical directions Yevjevich defined and studied.
4. Rivers which Yevjevich studied and the themes which he elaborated.
5. Donations of books, periodicals and memorabilia.
6. Planning of cooperation with the University of Belgrade and other institutions (Serbian Academy of Engineering).
7. General events happening in the planning of the dam and reservoir of Visina.
8. Solutions to the problems with part of the Visina Swamp.
9. Deposition of material at the derivation tunnel from the Visina Reservoir.
10. The most economical number of hydropower plants of the Visina System.
11. The future role of the Visina Reservoir in the basin of the South Morava River.
12. Combination of hydroelectric power of the Yugoslav part of Iron Gates I and II in the potential use of the Visina Reservoir for pumping water and producing hydropower.
14. Two events in the formation of pleasant and unpleasant situations happening in systems like the Visina System.
18. Pleasant and unpleasant events related to the Drina River.
21. Concentration of the head for the HE powerplant Ovcar-Banja.
22. Design and construction of the HE powerplant Blajinci.
24. Projects and studies:
   - HE Iron Gate 1
   - Vision of the future role of HE 1
   - Solution of economic problems related to the Morava River
   - Concept for the solution of Drina River pollution problems
   - Industrial pollution
   - Drinking water supply of Belgrade and central Serbia
   - Four special themes of interest to Yevjevich

NOTE: Contributions to Serbia & Montenegro water resources development by prof. Yevjevich have been described in a Serbian-language report. Only the list of topics from that report is described above. The intention is to translate the report into English, time permitting.
CONTENTS: (1) Three trips to South Africa; (2) First trip: Hydrology course in Pretoria; (3) Second trip: Passing through Johannesburg; (4) Third trip: Invitation to stop over in Johannesburg to visit gold mines; (5) South African professors on sabbatical at CSU; (6) Ongoing cooperation between South Africa and CSU.
47.1. THREE TRIPS TO SOUTH AFRICA. Yevjevich's three trips to South Africa were not initiated by him. All three were invitations by South African water resources institutions. The trips were to Pretoria, South Africa's capital, and Johannesburg.

47.2. FIRST TRIP: HYDROLOGY COURSE IN PRETORIA. For the first trip, Mr. Alexander, Director of the Hydrological Institute of South Africa, organized a course on stochastic processes in hydrology. There were only 57 seats in the hall were it took place, but there were more than 57 participants. A different space was needed to accommodate all, but none was available. Every lecturer would be pleased with that group of listeners. There was also an extra-curricular plan to visit Kruger National Park, the first modern park in the world. At that time, the revolution in Mozambique forced a large group of Portguese to pass through South Africa on their way to Brazil. The Churchill Creek was attractive to Yevjevich because it was easy to cross. The trip to the park was an unforgettable experience.

47.3. SECOND TRIP: PASSING THROUGH JOHANNESBURG. The second trip was a stop over, from Brazil to Tanzania and other east African states. At the Johannesburg airport Yevjevich met with several candidates for graduate research assistantship. Also, he spoke with professors who had applied for sabbatical leave at Ft. Collins, CO. This led to two students and two professors eventually going to CSU.

47.4. THIRD TRIP: INVITATION TO STOP OVER IN JOHANNESBURG TO VISIT GOLD MINES. Yevjevich came to Johannesburg to learn that there was a water intrusion problem in the well of a gold mine in the middle of Johannesburg. Pervious dolomite permits the penetration of water down to 600 meters below surface. But the water had gone 1,000 meters deep and had to be pumped out from that depth. Yevjevich was impressed by the modern technology used in excavating gold, as well as the leadership and the skills of the workers. Yevjevich suggested that the leaking water be contained at the 600 meters level and pumped out, not letting it go down to the 1,000 meter level. It was not a question of "whether" to do it, but "how" to do it.

47.5. SOUTH AFRICAN PROFESSORS ON SABBATICAL AT CSU. CSU has continued to accept both students and professors from South Africa. This is important for the South African economy. It gives them a good professional environment for their professionals.

47.6. ON-GOING COOPERATION BETWEEN SOUTH AFRICA AND CSU. The visits by CSU professors to South Africa created an atmosphere that was conducive to professional interaction. This also led to CSU's cooperation with South Africa on the Orange River Water Resources Plan. The results were published by Water Resources Publications of Littleton, CO. Mutual cooperation between CSU and South Africa continues to this day.
CONTENTS: (1) Distribution of water resources institutions in South Korea; (2) Lectures by three professionals: Yevjevich, Fontana and an Australian specialist; (3) Yevjevich's lecture on stochastic processes in water resources area; (4) Yevjevich's lecture on the connection between water resources and environmental prob (5) Visit to the southern part of South Korea and research institutes; (6) The southern area of South Korea as the scientific center of the country.
SOUTH KOREA

48.1. DISTRIBUTION OF WATER RESOURCES INSTITUTIONS IN SOUTH KOREA. For South Korea the distribution of water resources is a highly important economic subject. From the North Korean border to the southern tip of the Korean peninsula water has been beneficially used by the South Koreans. The main water resources research institutes are located in the south.

48.2. LECTURES BY THREE PROFESSIONALS: YEVJEVIC, FONTANÉ AND AN AUSTRALIAN SPECIALIST. Yevjevich and Prof. Fontane each gave about three lectures in South Korea. Yevjevich's lecture was on stochastic processes in water resources area, not just in hydrology. Prof. Fontane's lectures centre mainly on water resources engineering. The Australian colleague presented what had been done in the past field in Australia. Yevjevich was most impressed with three things in Korea: (1) Bhuddist influence in water area; (2) Dense vegetation covering most of the Korean peninsula; and, (3) How well the South Koreans are educated in the role of Bhuddism in relation to water resources development.

48.3. YEVJEVIC'S LECTURE ON STOCHASTIC PROCESSES IN WATER RESOURCES AREA. Much attention was given to Yevjevich's lecture, especially on the interaction of water resources development and environment.

48.4. YEVJEVIC'S LECTURE ON THE CONNECTION BETWEEN WATER RESOURCES AND ENVIRONMENTAL PROBLEMS. The lecture was very well received among South Korean professionals.

48.5. VISIT TO THE SOUTHERN PART OF SOUTH KOREA AND RESEARCH INSTITUTES. The South Koreans paid special attention to the visit of the three foreign lecturers to the South Korean research institutes.

48.6. THE SOUTHERN AREA OF SOUTH KOREA AS THE SCIENTIFIC CENTER OF THE COUNTRY. Quite possible that the southern part of South Korea will become one of the world's centers of water resource research and the place of new discoveries in this science.

Darrell Fontane, Dept. of Civil Engineering, CSU, wrote this letter to Prof. Yevjevich on 10 March 2004:

Dear Dr. Yevjevich,

I apologize for taking some time to respond to your letter. I have good memories but not very good records of our trip to Korea in 1993. We were invited to make presentations at the 1993 Annual Joint Symposium on Integrated Management of Water Resources and Quality in Reservoirs and Rivers, held in Taegon, Korea, on September 10, 1993. The Korean Water Resources Association sponsored this symposium. I believe that the association and the Korea Science Foundation funded our trip.

Some of the individuals we met with were Dr. Jong Ho Song, Dr. Seok ku Ko and Professor Soon Bo Shin. Dr. Song and Dr. Ko have both been honored by Colorado State University as Distinguished Alumni. Dr. Song served as president of the Seoul National University and Dr. Ko was president of the Korea Water Resources Corporation.

In addition to the presentation at the symposium we visited some of the major reservoir sites and met with the staff of the Korea Water Resources Corporation. We also each gave another talk in Seoul on September 13. I gave my presentation at Hyundai Electronics and I believe that you gave your presentation at the Korea Institute of Construction and Technology. I also remember that we had a dinner with some of your former students from Korea.

One of my favorite personal memories was us stopping at a small restaurant on the way to Taegon and eating eel. It was not my favorite, however, I remember our hosts being very impressed that we ate it! Also we went to the World Expo in Taegon and were given VIP passes to the rides and exhibitions.

Sincerely,

Darrell Fontane
March 10, 2004

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CONTENTS: (1) Cooperation with the University of Madrid; (2) Cooperation with the University of Valencia; (3) Study of the broken Tous Dam south of Valencia.

49.1. COOPERATION WITH THE UNIVERSITY OF MADRID. Prof. Sahuquillo, hydrogeological specialist, proposed a joint study on the bilateral use of conjunctive approach of stochastic and physical methods in solving contemporary water resources problems. The methods developed on that study were transferred by Spanish scientists and engineers to South American countries. Prof. Sahuquillo was involved in both projects, since he was both an honorary professor in Madrid and in Valencia.

49.2. COOPERATION WITH THE UNIVERSITY OF VALENCIA. The proposed cooperation between the University of Valencia and Colorado State University was approved by the governments of both countries and a study on the application of stochastic processes to hydrological time series was initiated. The leading professionals were Prof. Marco, from Spain, and Prof. Salas, from CSU. The most successful part was the conference on the same subject that took place on the seaside between Valencia and Barcelona. A large number of European participants, especially from Spain, showed a big interest for this topic.

49.3. STUDY OF THE BROKEN TOUS DAM SOUTH OF VALENCIA. When Yevjevich was involved with solving computational flood problems, a catastrophe occurred in Spain, when a natural flood destroyed the Tous Dam near Valencia. He had to make an in-depth study of the conditions that brought about this calamity. When torrential rainfall swamped the river basin south of Valencia, on which were two dams and two power plants, the downstream dam was destroyed and extreme flooding took place between the dam and the Mediterranean Sea. All factors that had an influence on negative results happened simultaneously. The dam consisted of two different parts: (1) Concrete with water spillway on it, and, (2) an earth part. Because there was no electrical power, the control pumps did not function when the flood occurred, and water overtopped the dam, washed out the earth part, and created the largest flood in the river’s entire history. To complete the tragedy, the reserve motors for the pumps could not be brought in from Valencia because many small bridges had also been destroyed. There was no electrical energy from the upstream power plant because the power house had been flooded. A typical case of everything going away that could go away! Sixteen people in elevators in a downstream town drowned, because they got stuck when the electricity went out and could not be rescued in time. This case showed Yevjevich and his Pentagon colleagues that safety issues are of paramount importance.
50. SRI LANKA

CONTENTS:
(1) Information on Sri Lankan water resources;
(2) Sources from students and literature;
(3) Bilateral ownership of Sri Lanka;
(4) Major agricultural production;
(5) Politics and agricultural cultivation;
(6) Attempts to learn how to utilize the land;
(7) U.S. reservations toward Sri Lankan politics;
(8) Tamil autonomy and agricultural production;
(9) Cultivation of tea.
50.1. INFORMATION ON SRI LANKAN WATER RESOURCES. Yevjevich never visited Sri Lanka, but he knew he had to get some information about the country, either through his students or through literature.

50.2. SOURCES FROM STUDENTS AND LITERATURE. Yevjevich accepted two excellent Sri Lankan Ph.D. candidates. Information which came from them was relatively reliable. These two sources of information seemed sufficient, but there was not enough on special irrigation systems used in agriculture, especially with regard to the "terrace" type of irrigation. Yevjevich complemented this information with other sources from literature.

50.3. BILATERAL OWNERSHIP OF SRI LANKA. Sri Lanka has two groups of people: (1) The Tamils in the north, and (2) the Sri Lankans in the south. There has been a great deal of disagreement between the two groups. Yevjevich accepted two M.S. students from the Asian Institute of Technology, Bangkok, Thailand, one from each ethnic group. This enabled him to obtain a more balanced perspective about Sri Lanka, as he received information from both sides.

50.4. MAJOR AGRICULTURAL PRODUCTION. Tropical plants, such as tea, chocolate, pepper, etc. constitute Sri Lanka's major agricultural production.

50.5. POLITICS AND AGRICULTURAL CULTIVATION. When you have two major competing groups in a country, it's normal to expect there will be much competition in most ways, including the usage of land for agricultural and other purposes. The same happened in Thailand, where the land was much better utilized than in Sri Lanka.

50.6. ATTEMPTS TO LEARN HOW TO UTILIZE THE LAND. When Yevjevich requested information on the bilateral ownership of Sri Lanka, he could never get reliable data, since ownership of the land is the conducton for political rights.

50.7. U.S. RESERVATIONS TOWARD SRI LANKAN POLITICS. The U.S. has been interested in settling Sri Lankan problems. Sri Lanka has been receiving a great deal of U.S. aid. Indian Prime Ministers have been very skillful in playing one side against the other. This is likely to remain until a practical solution to the problem is found, including everyday water resources issues.

50.8. TAMIL AUTONOMY AND AGRICULTURAL PRODUCTION. The Tamils wanted autonomy from the beginning of the creation of Sri Lanka (previously Ceylon). It is quite likely that Tamil autonomy would create a tendency for a separate state with a higher production of tropical plants for agricultural trade.

50.9. CULTIVATION OF TEA. Whatever changes in Sri Lanka, the production of tea will remain, and continue to come in three major types of quality.
51. SWEDEN

CONTENTS:
(1) Sweden's role in Scandinavian water resources;
(2) Yevjevich's connection with the University of Lund since 1961;
(3) Fulbright scholarship at the University of Lund;
(4) Course on stochastic processes in hydrology;
(5) Fulbright scholarship course approved and held in 1971;
(6) Promotion to Doctor Honoris Causa, 1974;
(7) Discussion of environment and water;
(8) Continuing observations of interest in water area;
(9) Quality of water as a problem;
(10) Stockholm Water Prize.

51.1. SWEDEN'S ROLE IN SCANDINAVIAN WATER RESOURCES. Whenever one likes to get a picture of Scandinavian hydropower, they usually go to Stockholm. When Yevjevich was planning a very large hydropower plant on the Drina River in the 1940s (Velika Dubrovica), the idea was to have 1 million kW installed capacity, serving as peaking power to Western Europe. The dam would flood the Drina River valley. Invited Swedish engineers consulting on the proposed project helped Yevjevich oppose this idea. They told Yevjevich they would never flood such a valley in Sweden. Yevjevich passed that judgment to the highest Yugoslav electrical power authorities. When they asked him what he thought, he told them he would go along with the Swedes. From that time Yevjevich had a good relationship with practicing Swedish engineers. When the Inform Bureau stopped contracts for the delivery of hydropower plant equipment, the Swedes immediately offered their used machinery. This further strengthened Yugoslavia's connection with Scandinavian technology.
51.2. YEVEVICH'S CONNECTION WITH THE UNIVERSITY OF LUND SINCE 1961. That connection
with Swedish hydraulic engineers evolved into Sweden's request for Yevjevich to receive a Fulbright
scholarship for a full summer course on the application of stochastic processes in hydrology.

51.3. FULLBRIGHT SCHOLARSHIP AT THE UNIVERSITY OF LUND. The course was approved for
the year 1971 and had 40 young engineers as participants. As the application of stochastic processes
was a novelty to the Swedes, there was a high interest in the course, both before and after the course.

51.4. COURSE ON STOCHASTIC PROCESSES IN HYDROLOGY. The students were supposed to
learn about developments in the application of stochastic processes in other countries. To strengthen
the connection with U.S. hydrologists, they proposed Yevjevich be promoted to Doctor Honoris Causa in
Technology.

51.5. FULLBRIGHT SCHOLARSHIP COURSE APPROVED AND HELD IN 1971. The course was held
in Lund, Sweden.

51.6. PROMOTION TO DOCTOR HONORIS CAUSA, 1974. Three years later, Yevjevich was granted
the title "Doctor Honoris Causa in Technology". During the ceremony, Yevjevich asked one member of
the Doctor's Committee why they gave him the title. The answer was, "You did very well in helping
different countries in the application of stochastic processes in water area. Neither your native country
nor your adopted country has recognized you for what you have done. So, we are giving you the
desired recognition".

51.7. DISCUSSION OF ENVIRONMENT AND WATER. As Mrs. Folkenmark was very actively studying
environmental problems, she and visiting scientists in water area discovered they had common interests.
Later, when the Nato's civilian Advanced Studies Institute started, several participants, including
Yevjevich, began a joint study of environment and stochastic processes in water area. When
Yevjevich's Ph.D. student Rodriguez Iturbe got interested in environment and water, he got the Water
Resources Prize of $165,000.

51.8. CONTINUING OBSERVATIONS OF INTEREST IN WATER AREA. With the relaxation of East
West political relationships, the interest in water area rose everywhere. This level of interest has been
maintained to this day.

51.9. QUALITY OF WATER AS A PROBLEM. The problem of water quality has gotten bigger over the
years. More and more money has been poured into modern observations of quality control, etc.

51.10. STOCKHOLM WATER PRIZE. To maintain interest in water area, the Swedes formed the
Stockholm Water Prize. By creating a protective division, they introduced water area distribution, which
makes the prize very interesting to people.

On March 25, 2002 Mr. Iturbe wrote the following e-mail to Yevjevich:

Dear Dr.Y,
How are you?..and your family?...I hope all is well. You are the only
person I am writing personally with the news that I was awarded the 2002
Stockholm Water Prize....the news became public in a press conference with
Sweden last Friday at San.I wanted to tell you personally because although
we are not very much in close contact you indeed meant a lot to me and
continue to do so now, many years later. How time has past!...I turned 60 a
week ago and I was 25 when I finish my Ph.D. working under your
guidance. Thanks so very much for all your support and guidance during those
years and specially also during the first years of my academic career. I am
so happy that I went to work under you at Colorado State University rather
than to any of the so-called scientific downtowns....under your leadership
was a superb and the best hydrologic research group in the world all those
years.
Mercedes and I think of you often and she joins me in sending you our
warmest regards,
Ignacio
CONTENTS: (1) Student visit from Grenoble, 1938-1939; (2) Practical internship at the hydroelectric power plant (Genissiat) under construction for a few weeks; (3) Visit to the hydraulics laboratory at Lausanne; (4) Visit to the Fluid Mechanics Institute of Zurich, 1949; (5) Visit to the eastern Alps, crossing from Germany through Switzerland to Italy; (6) Visit to the Lugano area; (7) Participating in several symposia and presenting papers in water area; (8) Invited lecturer on stochastic processes in water area at the Polytechnic Institute of Zurich.
52.1. STUDENT VISIT FROM GRENOBLE, 1938-1939. Yevjevich studied in Grenoble, France from October 1938 to June 1939. He suggested to the school administrators that foreign students got at least a few weeks of practical experience at the power plant in construction, known as Genissiat. The school accepted and approved this idea.

52.2. PRACTICAL INTERNSHIP AT THE HYDROELECTRIC POWER PLANT (GENISSIAT) UNDER CONSTRUCTION FOR A FEW WEEKS. As a result of his own suggestion, Yevjevich did an 15 day internship. He was exposed to the actual construction of the power plant.

52.3. VISIT TO THE HYDRAULICS LABORATORY AT LAUSANNE. Being in Switzerland at the time of his internship, Yevjevich visited the Hydraulics Laboratory at Lausanne.

52.4. VISIT TO THE FLUID MECHANICS INSTITUTE OF ZURICH, 1949. Yevjevich visited Zurich after WWII. The laboratory was one of the very best in Switzerland. It influenced Yevjevich in his planning of the hydraulics and fluid mechanics laboratory that was being created in Belgrade, Yugoslavia.

52.5. VISIT TO THE EASTERN ALPS, CROSSING FROM GERMANY THROUGH SWITZERLAND TO ITALY. Passing through Switzerland from Germany to Italy, Yevjevich would visit existing power plants in the eastern Alps.

52.6. VISIT TO THE LUGANO AREA. Switzerland was a sanctuary for Yugoslav refugees after WWII. Among these refugees were the sister, the mother-in-law and brother-in-law of Dobroslav Yevjevich, Yevjevich's uncle. Yevjevich visited his relatives in refugee camps near Lugano.

52.7. PARTICIPATING IN SEVERAL SYMPOSIA AND PRESENTING PAPERS IN WATER AREA. During the period 1960 to 1985 Yevjevich attended several symposia in Switzerland and presented his point of view on water area topics.

52.8. INVITED LECTURER ON STOCHASTIC PROCESSES IN WATER AREA AT THE POLYTECHNIC INSTITUTE OF ZURICH. Yevjevich's best lectures on stochastic processes area was delivered at the Polytechnic Institute of Zurich on several occasions.
53. SYRIA

CONTENTS: (1) Assurance that Turkey would supply enough water for the future irrigation of Syria; (2) Strengthening of the Gore Canal; (3) Study of the safety problem concerning Naval vessels' use of the military port of Latakia.

53.1. ASSURANCE THAT TURKEY WOULD SUPPLY ENOUGH WATER FOR THE FUTURE IRRIGATION OF SYRIA. The Syrian Government has always been very interested in the issue of whether the water of the Euphrates and Tigers Rivers would be evenly divided between Turkey, Iraq, Syria and other regional nations.

53.2. STRENGTHENING OF THE GORE CANAL. The Gore Canal is an irrigation canal in Syria. Yevjevich showed that the canal needed strengthening in order to insure the continual supply of water for irrigation purposes. Yevjevich proposed to increase water supply for the canal by increasing the proportion of water delivered to Syria. That proposal was accepted by the U.N.

53.3. STUDY OF THE SAFETY PROBLEM CONCERNING NAVAL VESSELS' USE OF THE MILITARY PORT OF LATAKIA. As Yugoslavia has a close post-WWII relationship with Syria, Syria designated the military command of the naval port of Latakia to be investigated on safety issues by Yugoslav engineers. Yevjevich was in charge of this Yugoslav contingent. The model of the port was designed at the Avala Laboratory in Belgrade, Yugoslavia.
54. TAIWAN

CONTENTS: (1) Lecture at the University of Taiwan; (2) Hurricanes; (3) Ph.D. students; (4) Competition of staff members; (5) Typical event.

54.1. LECTURE AT THE UNIVERSITY OF TAIWAN. Prof. Mao had the same name as the Chinese leader. He spent some time with Yevjevich as the visiting professor at Colorado State University. Mao insisted to have other Taiwanese professors as visiting professors at CSU, as a symbol of freedom from Communist China. He gave Yevjevich a gift: a model of vessels from the Ming Dynasty. The vessels were used for boiling water 3,000 years ago. However, during 3,000 years of boiling water for cooking meals, large swaths of forest have been destroyed all over Northern China. Energy was obtained by burning wood, resulting in deforestation.

54.2. HURRICANES. In Taiwan, hurricanes result in large floods. This gives Taiwanese students experience in tackling flood problems.

54.3. PH.D. STUDENTS. Mainland China immigrants to Taiwan have been good students. Over time, they have shown to be excellent Ph.D. candidates. Some have received Taiwanese immigration status on account of their academic performance. Most of the Taiwanese Ph.D. students at CSU have been given immigration status in the USA, by invitation of various governmental agencies.

54.4. COMPETITION OF STAFF MEMBERS. The Taiwanese Government has been able to introduce a competitive element between professors and designers of water resources projects. This has been very beneficial to the country in terms of water resources development.

54.5. TYPICAL EVENT. During the hurricane season a typical occurrence is a flood breaking a river embankment. The major natural disasters in Taiwan are hurricane-produced floods.
55. TANZANIA

CONTENTS: (1) Lecture at the University of Dar es Salaam; (2) Water supply at Dar es Salaam; (3) Planning water resources development.

55.1. LECTURE AT THE UNIVERSITY OF DAR ES SALAAM. As the UN installed the government of Tanzania, its credibility was at stake. The UN assigned Yevjevich to deliver a lecture on how to solve the development problems in Tanzania, including how to get a social-democratic regime functioning in the former European colony.

55.2. WATER SUPPLY AT DAR ES SALAAM. One issue Yevjevich worked on was the problem of water supply. This was the most interesting aspect of Yevjevich's work. Water supply problems in Dar es Salaam were easily solved.

55.3. PLANNING WATER RESOURCES DEVELOPMENT. The planning Yevjevich did was on a basin wide scale. It was done with the technical assistance of the UN. The UN succeeded in implementing the planning of this project and applying it to other developing nations.
CONTENTS: (1) Fight against endemic syphilis; (2) Field trips in connection with endemic syphilis; (3) How to travel in a country without knowing the domestic language; (4) The first large dam at Chiangmai; (5) The Plain of Korat; (6) Problem of street drainage in Bangkok; (7) First Ph.D. student from Thailand at CSU; (8) Water resources of the Malayan Peninsula; (9) Mekong River Fall.
THAILAND

56.1. FIGHT AGAINST ENDEMIC SYPHILIS. When Yevjevich came to Bangkok on a UN contract to apply his methods of investigating raw hydropower of rivers, he met Yugoslav doctors in a team of Thai doctors checking endemic syphilis in rural areas of Thailand. He joined them to get acquainted with those areas of Thailand and the problems associated with drinking water, expecting to start the work on the UN contract.

56.2. FIELD TRIPS IN CONNECTION WITH ENDEMIC SYPHILIS. Yevjevich never drank natural water in Thailand, and probably never would have joined the above group had it not been for the Fanta soft drink he drank.

56.3. HOW TO TRAVEL IN A COUNTRY WITHOUT KNOWING THE DOMESTIC LANGUAGE. Yevjevich developed a minimum communication method with people who didn’t speak English. He got 500 Thai words written phonetically in Cyrillic. With that he traveled all over Thailand without an interpreter. However, when he was in Japan, he invented another communication method. For individuals younger than 30, he would write in English and show this to the person he wanted to get an answer from. Young Japanese understood written English and answered in writing, but couldn’t communicate verbally.

56.4. THE FIRST LARGE DAM AT CHIENGMAI. The Economic Commission for Asia and the Far East in Bangkok gave Yevjevich a project on the arch-gravity concrete dam at Chiangmai. He was to assess the dam’s safety. He found that there was about 25% more concrete than necessary. However, the cement producers fought very hard to keep the same volume of concrete, not knowing that more concrete than needed is less secure. Yevjevich based his calculations on experience from his work on the Jablanica HE plant in Yugoslavia, where military concerns overrode scientific measures on the amount of concrete needed for the safest construction of the dam.

56.5. THE PLAIN OF KORAT. The Korat Plain is a very arid area for the tropical climate that prevails in the region. Yevjevich visited the Plain, giving advice in matters related to the future irrigation to the University of Korat, which was being created there. Later, he also saw to it a Korat University student obtained his Ph.D. in the USA.

56.6. PROBLEM OF STREET DRAINAGE IN BANGKOK. Bangkok has been flooded more than once by the river which passes through the city center. The canals called “klongs” have not only been used for drainage but also for navigational routes for small merchant vessels needing access to markets. Yevjevich was of the opinion that sooner or later the canals would have to be modernized, but not as a closed conduit, which was done later.

56.7. FIRST PH.D. STUDENT FROM THAILAND AT CSU. Yevjevich had the first Thai Ph.D. candidate, Subin Pinkajan. He received a Master’s Degree from the Asian Institute of Technology at Bangkok. Yevjevich and Pinkajan stayed in touch for more than 40 years. In addition, another 10 students got their Ph.D. or M.S. degrees under Yevjevich’s adviseship. Dr. Pinkajan created the largest South-East Asian water resources engineering consulting firm. He has been successful in obtaining investments in Laos for the construction of a hydropower plant on a Mekong River tributary in Laos. Recently, Yevjevich suggested to Pinkajan to get in touch with China in order to connect three rivers near each other, the Yangtze, Irrawadi and Mekong. This could create the largest hydropower production in the world.

56.8. WATER RESOURCES OF THE MALAYAN PENINSULA. Yevjevich had the opportunity to travel along the Malaysian Peninsula, and study water resources on two sides of the peninsula. Because the peninsula runs from north to south, the high river flows are seasonal, with one side having the rainy season for 6 months and the other side having a 6-month dry spell, and vice versa. Yevjevich proposed not to build to much storage capacity on each side. Rather, the two sides should be connected by tunnels, equalizing water access to power plants.

56.9. MEKONG RIVER FALL. As discussed in the case of Cambodia, the Mekong River Fall was measured by the French during colonial times, and later by the UN. Because the fall is constant over the rocky riverbed, Yevjevich suggested to make measurements of the flow for different levels and establish a rating curve.
CONTENTS: (1) Cooperation with University of Istanbul; (2) Water supply system of Istanbul; (3) The role of the Bosporus Narrows; (4) Gebze factories; (5) The role of the Dardanelles Narrows; (6) Bursa—Sarajevo comparison; (7) Izmir Ph.D. program; (8) Fethiye; (9) Antalya; (10) Travertine Plateau; (11) Dumanlı spring; (12) Alanya coastal area; (13) Mediterranean kast coast; (14) Adana region; (15) Role of Euphrates - Tigris water development projects; (16) Keban power plant; (17) Konya region; (18) Delaman and Esenchay Rivers; (19) Hydraulics Laboratory of Ankara; (20) Anatolya Plateau.

57.1. COOPERATION WITH UNIVERSITY OF ISTAMBUL. Yevjevich's first visit to Turkey was during an international conference and a visit to the University of Istanbul. He was interested in the historical use of the Bosporus and the Dardanelles, the connection between the Mediterranean and the Black Sea. He got acquainted with Turkish professors in water area and kept those connections for many years. The university was involved in the planning of water supply to Istanbul.

57.2. WATER SUPPLY SYSTEM OF ISTAMBUL. Yevjevich was surprised at the complexity of the water supply system. There were two parts: European and Asian. A large number of small reservoirs fills the needs of the city. Many conferences have been held in the city, usually close to the Bosporus.

57.3. THE ROLE OF THE BOSPORUS NARROWS. Yevjevich got acquainted with the hydraulic engineer of a Turkish governmental agency and professor at the University of Istanbul, Dr. Senturk. Yevjevich maintained a close professional relationship with him for the rest of his life. His house was near the Bosporus. Whenever something of interest in the Bosporus area was happening that involved Yevjevich, he would be helped by Dr. Senturk. For example, when problems arose, Yevjevich would obtain critical information on how to solve those issues. In return, Yevjevich's publishing company, WRP, published Senturk's books on hydraulics of reservoirs, sediment transport, etc.
57.4. GEBZE FACTORIES. This is a small industrial city on the Asian side of Istanbul. Yevjevich’s best friend from his early days in Yugoslavia, a Moslem industrialist who immigrated to Turkey in 1938, became one of the most successful Yugoslav immigrants in Turkey. According to rumors, he was paying the highest amount of income tax in Turkey during the 1960s. He changed his name from Haji-Hamzic to Cambol. His three sons became engineers and his daughter became an international affairs attorney. They have plastics and heavy metal factories, working with military contractors. Yevjevich visited him several times when on business in Turkey. He visited Yevjevich in the USA. Being from Sandjak, a Serbian Province, they were both against the way Christians and Moslems related to one another in (the former) Yugoslavia during recent times. In some way Gebze was a place Yevjevich considered his “HQ” when working on projects in Turkey. After Cambol’s death, Yevjevich remained in touch with his family, especially the engineer Ahmet Cambol.

57.5. THE ROLE OF THE DARDANELLES NARROWS. This is the famous historical place, well-known for the legend of Troy, as well as the WWI battle. Of course, it is the gate to the Mediterranean and Black seas.

57.6. BURSA–SARAJEVO COMPARISON. Yevjevich spent eight years in high school in Sarajevo, Bosnia (1924–1932). He was amazed to see the main street of Bursa to consist of cobble stones, as well as the type of water supply and sewage systems — the same as in Sarajevo. He asked who made these structures. The reply was that Sarajevo is a copy of Bursa. So, Yevjevich inadvertently found the answer to the question of who did the Sarajevo street/water/sewage systems, and why. He also discovered that if a Pasha (Turkish rulers of Provinces) make a mistake, the Sultan would castigate him by sending him to Sarajevo. An anecdote: One Pasha was condemned to Sarajevo. The next day the Pasha came to the Sultan with a rope hanging from his neck. “Your Excellency, I would rather be hanged than sent to Sarajevo”. Ironically, Yevjevich was a consultant in some of the aspects of removing cobble stones and solving water supply and sewage problems by introducing modern systems.

57.7. IZMIR PH.D. PROGRAM. Turkey has three big European-style cities: Istanbul, Izmir and Ankara. Yevjevich gave lectures by invitation in all of these cities. In 1980 he accepted a Turkish lady, Dr. Nilgun Harmancoğlu, as his assistant at George Washington University. For two years she was also his co-author on many papers. She became the best theoretical engineer in hydrology and water resources. She went back to the University of Izmir and created the best Ph.D. program in hydrology and water resources engineering in Turkey.

57.8. FETHIYE. The UN financed a project on Mediterranean karst water resources problems on the Turkish coast, from Izmir up to Adana, including Fethiye, Antalya, and Alanya. Fethiye is a small touristic town, a typically Turkish Mediterranean attraction. Yevjevich used the Turkish Government offices in Fethiye when he worked on this project. There he learned that three economies exist in Turkey: Big cities with European-style economies; a governmental economy, where the prices are completely different than in big cities; and small villages economy, especially in the mountainous areas. It was interesting to see how all three economies could operate at the same time.

57.9. ANTALYA. An interesting city, located on a large limestone-travertine deposit. There are many springs on the plateau. However, Yevjevich found there is only one big spring, coming out of an underground limestone water aquifer. The outflowing water is divided into 40 small springs. It is used for irrigation and water supply of the city. Yevjevich made a special study of the travertine deposits.

57.10. TRAVERTINE PLATEAU. The groundwater coming out of the limestone brought dissolved calcium carbonate, which partially deposited under the water surface and partially above the surface. Comparing the volume of the travertine plateau (both surface and sea parts) with the estimate total groundwater volume, Yevjevich concluded that they are very nearly equal. In other words, the karst water has created the plateau and all of Yevjevich’s planning of the plateau was based on this finding (only one spring).

57.11. DUMANLI SPRING. During the time Yevjevich studied Mediterranean karst, a large dam on a river near Antalya was being built at Oimapinar. The reservoir created by the dam flooded the spring which Yevjevich found to be the largest known karst spring from one hole in the world. The estimate was
that the smallest discharge during the dry season was between 20 to 23 m³/s. Thus, Yevjevich made a
daring hypothesis: In one relatively concentrated area there are two independent water quantities in
karst, both of which are the largest of their kind in the world, namely the largest karst water acquifer and
karst water discharge from one hole. The geological constellation is such that the water from the karst
spring cannot escape from the reservoir. Yevjevich considered that three geological units should be
studied in the future: The largest karst groundwater acquifer in the world, the largest travertine plateau
created by the karst spring in the world, and the largest karst spring from one hole controlled by the
reservoir in the world. Yevjevich also found that the karst situation in the mountains near the sea is of
the succession type, namely stepwise from pervious to impervious, etc., concentrating in the outflow of the
Dumanli spring.

57.12. ALANYA COASTAL AREA. One can find proof that the last ice age was created in such a way
that the sea retreated 125 meters lower than it is today, so the erosion base decreased by 125 meters.
At that depth, there are springs, which were created during the ice age. Today, sea lions raise their
young in those depth because of the fresh water coming from the coastal area. Yevjevich is convinced
that Turkish Mediterranean karst can be used to determine the future development of the karst springs
around the Mediterranean Sea. That change of the erosion base makes it difficult to separate fresh
water from saline water. The problem of this mix is hard to resolve.

57.13. MEDITERRANEAN KARST COAST. In Turkey every fresh water spring along the coast is used
for irrigation of vegetables in greenhouses. However, unsuccessful attempts to separate fresh water
from saline water can be explained by the consequences of the ice age and the change of the erosion
base, as well as karst spring formations.

57.14. ADANA REGION. The two big rivers in this area, Euphrates and Tigris, are very important to
several countries, particularly Turkey, Iraq, Syria, Lebanon, Jordan and Israel. At present, it is a very
dangerous area, like the Nile and the problems in North Africa. Adana was the limit on the
Mediterranean coast which Yevjevich visited on his karst project. Turkey has to divert water for irrigating
very large arid areas east of Adana. That's the reason why Turkey had two very significant water
resources problems: water for irrigation of these large areas and large hydropower production in the East
to be diverted to the West of Turkey. Yevjevich thinks that both the Euphrates–Tigris problem and the
Nile problem should be resolved by the United Nations.

57.15. ROLE OF EUPHRATES - TIGRIS WATER DEVELOPMENT PROJECTS. Turkey has resolved
some of its problems by building reservoirs and power plants on the Euphrates and Tigris, leaving
developments of smaller rivers to the West of the country for the future. Two examples are given in
Yevjevich's report, submitted to the UN. They are the Dalaman and Esençay Rivers. They both drain
the Anatolya plateau, which is a semi-arid area. It will be a dilemma for Turkey whether to accumulate
water on the plateau and divert it to the sea for the production of hydroelectric energy, or to use it only
for the irrigation of the plateau. A third option would be a compromise of the two economic aspects.

57.16. KEBAN POWER PLANT. This is the first power plant built on the Euphrates. During the
construction, the large cavity in the limestone was not discovered. When the Keban Dam was made
operational, water started to leak, first in small quantities, then in bigger. Yugoslav hydrogeologists
helped solve this problem by assisting Turkish experts.

57.17. KONYA REGION. This area is the center of several new reservoirs which lose water. The Konya
plateau doesn't have a water outlet to the sea (North or South). There is a plan to transfer the flood
waters from the plateau to the sea.

57.18. DALAMAN AND ESENÇAY RIVERS. The issue of the two alternatives for these rivers, mainly
hydropower production, or mainly accumulation of water on the plateau for irrigation, has to be resolved.
One has the impression that some Turkish water resources leaders are reluctant to make a decision.

57.19. HYDRAULICS LABORATORY OF ANKARA. When Yevjevich visited Ankara, prof. Senturk,
Director of the Hydraulics Laboratory of Ankara, invited Yevjevich to show him the laboratory and the
type of work that was being done there. The land around the laboratory was practically without trees.
Senturk told Yevjevich that Alexander The Great hid his elephants in the Cedar forest that used to be there. Yevjevich commented that over the centuries the ax had played a big role. Many arid regions all over the world have been created by people who did not permit the regrowth of trees and forests, such as farmers in this area of Turkey.

57.20. ANATOLYA PLATEAU. Yevjevich thinks the erosion problems that exist in this area are comparable to those that have been causing trouble in Italy, Spain and North Africa. The plateau will have to undergo erosion control, reforestation and irrigation on productive land.

NOTE: The amount of information presented here arises from the fact that Yevjevich was more involved with work in Turkey than in most other countries. When he was invited to give two lectures on novel methods of solving hydrologic and water resources problems in Ankara, November 2002, an elderly Cypriot hydraulic engineer commented about all the things Yevjevich has done for the country. He indicated that he and other colleagues would celebrate Yevjevich's birthday in October, 2003, which they did. If Yevjevich continues to help Turkey the way he has done in the past, the entire country will celebrate Yevjevich's 100th birthday in October 2013.

Belgrade, Serbia, October 12, 2003: Professor Vujica Yevjevich's 90th birthday celebration.
Left to right: Prof. Dr. Mionir Vukobratovic, President of the Serbian Engineering Academy; Vujica Yevjevich; Vlastimir Purić, retired hydraulic engineer and Yevjevich's former student.
CONTENTS:
(1) London;
(2) Bristol;
(3) Wales;
(4) Scarborough;
(5) East Anglia;
(6) Scotland;
(7) Loch Ness;
(8) Edinburgh;
(9) Private ownership of water.
58.1. LONDON. Yevjevich was invited by the City University of London to spend his sabbatical leave there. He delivered a full course on the application of stochastic processes in water area and had some of the best students of his career in London. When the sabbatical ended Yevjevich accepted an invitation to present the course again, this time at the Imperial College of London. He also repeated the course at the University of Birmingham. London has been a point of transit for Yevjevich during many overseas trips, usually from the USA to Belgrade, and vica versa. The only other large European city that Yevjevich has visited this often is Paris.

58.2. BRISTOL. Yevjevich visited the Bristol area in order to get acquainted with some of the characteristics of underground water supply from limestone (chalk). He was amazed at the chalk formation (water bearing geological formation). He got acquainted with the British government’s large-scale reforms in water supply of different areas in England. Several times Yevjevich visited with Mr. Roundtree, one of Britain’s water supply reformers.

58.3. WALES. Wales is an interesting part of Britain from the perspective of water supply and natural beauty.

58.4. SCARBOROUGH. To Yevjevich, this area seemed like a typical representation of the British water supply situation.

58.5. EAST ANGLIA. Several times in his professional career Yevjevich had conflicting views on climate change with East Anglia climatologists. Because some very dry years occurred in East Anglia during the Middle Ages, they have been trying to extrapolate this phenomenon by applying it to other parts of the world where those extremely dry years did not happen at the time. For example, during the UN conference on environmental problems in Rio de Janeiro, Brazil, Yevjevich asked an East Anglia professor what the climate was during the Tertiary Formation when nearly all carbon-dioxide was in the atmosphere. Instead of a dry climate, it was a very humid climate with lush vegetation, which some of the largest animals ever (dinosaurs) fed on. The British expert could not give an answer to the question.

58.6. SCOTLAND. The need for delivering hydroelectrical equipment for Yugoslav power plants made Yevjevich visit Scotland on several occasions. He liked the country and he had good interactions with Scottish engineers.

58.7. LOCH NESS. Yevjevich liked visiting Lake Ness, famous for its mysterious Monster. This reminded him that in some other countries similar myths existed, likely for the purpose of attracting tourists.

58.8. EDINBURGH. Yevjevich enjoyed this city for its folklore and water area structures for water supply systems.

58.9. PRIVATE OWNERSHIP OF WATER. When UNESCO asked Yevjevich to look into the question of private ownership of water in the world, he already had an example of his colleagues in Ft. Collins, CO. who owned a certain amount of water in the Horsetooth Reservoir. He also had another example of a ranch in Denver, which was not used for cattle but for the ownership of water supply. On this basis, he found that in the U.K.’s reform of water supply there are elements of private ownership of water in water supply, like some European companies that sell water along with water supply projects.
LIST OF 8 MAJOR SUBJECT AREAS SELECTED BY PROF. YEVJEVICH AS EXAMPLES OF HIS CONTRIBUTIONS TO WATER RESOURCES DEVELOPMENT OF THE UNITED STATES OF AMERICA.

List of structures, projects, studies, revisions of projects and other works by prof. Yevjevich, which can be considered as his contributions to the development of water resources of the United States of America.
1. Introduction to contributions
2. Logistics of moving a family of five from Yugoslavia to the U.S.A.
3. Time spent on different work functions in the U.S.A. from 1956 through 2003
4. Time and research accomplished for two US agencies: National Bureau of Standards and USGS
5. Twenty years of service as professor at Colorado State University, Ft. Collins, CO.
   - First important conclusion
     - Evaluation of the mean annual flow of the Colorado River
     - Consulting on solution mining in Canada
     - Estimation of 100-year flood in Santa Clara County, California
     - Consequences of dual-cavity technology
     - Increasing the size of crystals of potash salt by modification of crystalizer
     - Redesign of limestone kills in Corpus Christi, TX.
     - Review of small practical solutions in water resource engineering
6. Publishing activities of hydrology and water resources program at Colorado State University
   - Colorado State University hydrology papers
   - Published papers and books by Yevjevich
   - Accounting for work hours
   - Type of work done at George Washington University
   - Interactions with graduate students
7. Various aspects, offers of knowledge on large evaporation research on evaporation of large bodies of water or swampy lands
   - Building a university and water programs
   - Contribution to country of origin
   - International activities
   - Professional activities
   - Educational activities
   - Consulting activities
   - Bilateral meetings
   - Lecturing and advising visits
8. Major contributions by Yevjevich

NOTE: Contributions to United States of America water resources development by prof. Yevjevich have been described in a report of 62 pages and 6 figures/maps. Only the list of topics from that report is described above.

The USA report is enclosed as a companion report in the continuation of this report.
CONTENTS: (1) Tropical South America; (2) Dense forests; (3) Orinoco River.

60.1. TROPICAL SOUTH AMERICA. Yevjevich concluded that to study tropical countries in South America, one of the best places to do so is Venezuela. There is an amazing variety of vegetation. Oil fields are found in Venezuela because of the abundance of lush vegetation that covered most of the country in the past.

60.2. DENSE FORESTS. Yevjevich was impressed by the density of Venezuelan forests. If a school on tropical climate and vegetation were to be created somewhere, Venezuela would be an excellent candidate as a practical location.

60.3. ORINOCO RIVER. Both the upper and lower part of the river are of interest to those studying how tropical river floods are generated and what effects they have.
EPILOGUE

TIME REFERENCE FOR VARIOUS SERVICES AND CONTRIBUTIONS.

It is easier to explain what wasn’t done than what was done. There are no dates for many of the events described in the text. In some cases more recent contributions have been mentioned before or, instead of, previous contributions made in earlier times. The text covers Yevjevich’s experiences, reactions, opinions, errors and successes as he experienced them. Specially discussed are resulting events, such as consultations and other results of professional interactions. For example, see the letter which Prof. Fontane wrote to Yevjevich (p. 91), which is a typical way of how some individuals reacted to Yevjevich’s work. What was shown in the text is that for Yevjevich the actual events are always more important than what was planned to happen. Therefore, it is unnecessary to make a chronological presentation of events. Rather, the objectives and accomplishments are of far greater importance.

ABSENCE OF A RIGID METHOD OF PRESENTATION.

Similar to the absence of exact chronological information, there is an absence of strict methodology in the presentation of Yevjevich’s contributions. The reason is that the methods used to describe the events were tailored to those events. Every lecture Yevjevich gave was somewhat different than any other on the same subject matter. Yevjevich’s principle is that every case is unique, be that a lecture, a student, an interview, a university or something else. Yevjevich would be adaptable to different needs, giving and taking as required. Without such an approach the effects of the transfer of knowledge would not have been so successful. For instance, to create a world class hydraulics laboratory in Serbia, Yevjevich worked in no less than five countries: France, Italy, Germany, the U.K. and The Netherlands. In each one he found some aspect of what would be needed for the Avala Hydraulic Laboratory in Belgrade. The French engineer, scientist and phylosopher Quacot influenced Yevjevich. Yevjevich followed this principle: every new accomplishment in creating water resources engineering should be based on novel approaches. Yevjevich was especially proud of his dual-cavity mining invention. His methods were always based on feasibility and how goals can be realistically accomplished.

SPECIAL PHENOMENA.

In the last several decades there have been many scientists who organized movements with the aim of solving problems which might endanger life of Earth as we know it. Some examples are the ozone layer, global warming, acid rain, decomposition of large reservoirs, droughts and floods, etc. Different scientists and organizations hold different positions on these matters. When the aggressiveness of governmental opponents peaked, cautious scientists met in Arizona. These professionals, previously exercising restraint in matters of opinion, changed their attitude and became more radical in their stance towards these issues and the various governments. Yevjevich was the only invited hydrologist who came to the meeting, also having been invited to participate in the discontinuation of Lake Powell on the upper Colorado River, and the dam, one of the highest dams and largest underground reservoirs in the world. Yevjevich’s position was simple. Most of the phenomena discussed in Arizona were random processes, changing in time and space. If an event very rarely occurs, it may not be as dangerous to us as some scientists would like to claim. On some of the following questions Yevjevich never got a reply: What is the state of acid rain and acid lakes today (not five years ago)? Is the hole in the ozone layer increasing or decreasing today? Are droughts and floods increasing in the world? Is the Gobi Desert becoming a forest again (as it used to be) or does human activity prevent that? And so on.

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INTERNATIONAL MEETINGS

When a congress on geophysical time series was organized in Moscow, every climatologist, meteorologist, hydrologist, oceanographer, etc. only spoke about his own narrow field of interest. They were very impressed by Yevjevich's broader analyses of atmospheric time series processes, as well as other areas. He started with the assumption that satellite solar radiation measuring instruments above the atmosphere have no significant random incoming radiation, rather, nearly completely periodical input. When the same instrument is put on the Earth's surface, to include atmospheric influence on radiation, the order of the magnitude of random effect of atmosphere increases the autocorrelation of daily radiation to the order of 0.1 +, so the first influence on randomness is in the atmosphere. Solar radiation is a deterministic, almost period process, with very little randomness. When heat passes through the atmosphere, then the process also becomes partially stochastic, governed by chance. When heat warms up the atmosphere, the process becomes more stochastic. When one analyzes rainfall and runoff as a consequence of that heat, then time series have non-negligible stochastic components.

SERVING SCIENTIFIC AND ENGINEERING INTERESTS OF MANY COUNTRIES.

The more than 60 countries that were looked at in this report show the complexity of fluid processes in time and space on the Planet. Studying those processes, Yevjevich identified four components in the processes of geophysical time series. Yevjevich calls them TIPS properties: Tendency, Intermittency, Periodicity and Stochasticity. He could not identify any other component as important as these four.

GUIDING PH.D. CANDIDATES AT UNIVERSITIES.

Being the professor in charge of the water resources graduate and research program at CSU, Yevjevich was an advisor to 50 Ph.D. candidates over a period of some 20 years. He developed his own methods of selecting and advising graduate students. Both students and professors are responsible for successful Ph.D. studies. Time permitting, he would like to write a book on his methods on how to guide doctoral candidates.

ERRORS AND OMISSIONS.

This text was written on the basis of Yevjevich's own recollection. No official or unofficial records in any form (written, audio, visual, etc.) were used, with several exceptions, such as the copy of an e-mail, a letter, etc. As a result, it is likely that not everything from Yevjevich's professional life is covered herein. Similarly, it is possible that the text contains errors.

CONCLUSION

The main reason why Yevjevich decided to write this report is the tendency of institutions to subjectively present their points of view. Yevjevich's point of view exists as a record in order to present an objective, or at least a more balanced, perspective of these events.
CONTRIBUTIONS BY PROFESSOR VUJICA YEVJEVICH TO ADVANCEMENT OF NATIONAL WELLBEING OF THE UNITED STATES OF AMERICA

Period of Time 1958-2005

Data using in this report are basically derived from written information except when personal data are being available for the first time

PART IV

Highlands Ranch, Colorado, USA
2005
# PART IV REPORT ON CONTRIBUTION OF NATIONAL WELLBEING OF THE UNITED STATE OF AMERICA

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Chapter 1

INTRODUCTION TO CONTRIBUTIONS OF DR. VUJICA YEVJEVICH TO THE WELLBEING OF THE UNITED STATES OF AMERICA

This report is in essence written by Prof. Vujica Yevjevich.

The year 2003 one may distinguish five distinct periods of time in the 90 years of life and work of Dr. Vujica Yevjevich. These periods are:
1. From the birth on October 12, 1913 in Southwestern Serbia to the beginning of the Second World War for Yugoslavia in April 1941;
2. War years period 1941-1944;
3. Post war period in Yugoslavia, from October 1944 to February 1958;
4. Major time in U.S.A., from February 1958 to the second retirement in November 1987; and
5. Retirement years 1987 to 2003, living and free-lance working in Highlands Ranch, a small city in Colorado, U.S.A., where this report was written.

Period 1913 through April 1941. He is born in Kasidoli, a rural community near the small city of Priboj (pronounced priboy). He spent his early years of life in Priboj, where he attended the primary school. His father was Mihailo, a protoyer of Serbian Eastern Orthodox Church, and mother was Darinka Jovanovic. He finished 8-year high school (gymnasium) in Sarajevo, Bosnia, in 1932, and the University of Belgrade in 1936 by obtaining the degree of civil engineer, hydraulics orientation. October 1936 to June 1937 he went to School for Reserve Engineering Officers. From June till December 1937 he worked in Belgrade on odd engineering jobs. On December 1, he started the appointment in Skopje (capital of today’s Macedonia), by the Federal Ministry of Public Works of Yugoslavia. He obtained the degree of hydraulic engineer under a French Government fellowship, of Grenoble, France in June 1939.

Period 1941-1944. In the time prior to April 1941, he was working on many small hydraulic projects in Macedonia, part of Yugoslavia at that time. The German Army invaded Yugoslavia in April 1941. Yevjevich was mobilized as a reserve officer, and became a prisoner of war a couple of weeks after. He spent nine months in four prison camps in Germany from April to December 1941. Transferred to Italy, he spent December 1941 through September 1943 in three Italian prison camps. After 21 months, he escaped from a prison camp in Northern Italy in September 1943 when Mussolini’s government resigned, and went to Rome, expecting American troops to enter Rome. He waited nine months hiding in Rome.

After arriving in Rome, the American Air Force transported ex-Yugoslav prisoners of war to the Island of Vis, at that time the seat of Provisionary Yugoslav Government in June 1944. Yevjevich was assigned the duty to plan the recovery of the most destroyed cities of Yugoslavia in the war. In effect that was the release from the Army. After
Belgrade was liberated in the fall 1944, the U.S. Air Force transported the employees of the Yugoslavian government from Vis to Belgrade in October 1944.

**Period October 1944 to February 1958.** This period of about 14 years is likely the most intensive working and professionally responsible time in the life of Dr. V. Yevjevich. During this period, Professor Yevjevich became also a relatively prolific writer of engineering short articles, mainly in domestic journals, and hydrologic scientific paper in both domestic and foreign journals. Being a responsible for planning the development of water resources of many river basins in Yugoslavia, he decided to write a practical book: **VODOPRIVREDNA OSNOVA** in Serbian language, which was a novel terminology in Serbian, meaning WATER RESOURCES SCHEME. It was written in seven days, with 77 pages of small size. In that period he published 45 papers, three books, and his doctoral thesis.

**Division of 45 years of living and working in the United States of America 1958-2003**

The time of 45 years may be divided into four periods:

1. Time in serving the U.S. Government in Washington D.C., February 1958-September 1960 (1 year and 7 months);
2. Time in serving as professor at Colorado State University, September 1960-November 1979 (19 years and 2 months);
3. November 1979-November 1987 (8 years) time spent as Research Professor at George Washington University, Washington D.C.; and
4. Serving part time CSU, NATO Civilian Science and Environmental Affairs Division, serving different national and international societies, etc., November 1987 to November 2003 (16 years).
Chapter 2

LOGISTICS OF MOVING A FIVE-MEMBER FAMILY, ON THEIR OWN EXPENSE, FROM A SOCIALIST COUNTRY OF EUROPE TO THE UNITED STATES OF AMERICA.

Invitation for 18 months joint research work with the U.S. National Bureau of Standards. The emphasis to be on: (1) Characteristics of the outflow hydrographs in function of the known properties of the outlet orifices, eventually experimentally determined orifice hydraulic properties, or assumed fluid mechanics responses to outflows, and (2) Assumption that the river is three-dimensional conveyance structure.

Background of Professor Yevjevich was such that he could relatively easily meet the professional expectation of the invitation by the Bureau. He already knew what was going on the subject of flood waves created either by military means or caused by sabotage or chance. The European interest was created by the details of the results of bombing of the two dams (Moehne and Oeder) in the Ruhr Region of Germany during the Second World War by the British Air Force. That interest was fomented in Europe, especially because of the atomic bombs exploding over Japan.

Yevjevich, encouraged by the Yugoslav military, was very well versed on the effects of bombs of 5000 kilograms on concrete gravity dams. Under contract with builders of hydroelectric power plants, he built the river model to study two problems, the outflow through holes in the dam and the propagation of flood waves along the three-dimensional channels at the Hydraulic Laboratory at Avala. The opinions of European specialists were that the American colleagues are much ahead of them on the subjects of unsteady flow in open channels.

Yevjevich, looking for an opportunity to visit research centers in USA, found it in the International Congress on Hydraulic Research in Minneapolis, Minnesota 1953. A request to the sponsor of Avala research and to the Government of Serbia had approval of a two months visit to USA (congress in Minneapolis and tour of laboratories and research centers.) So Yevjevich went to Hydraulic Congress and toured USA for the rest of time. It was a very frugal travel (from Yugoslavia to New York City by cargo ship, in USA by buses or trains mostly). The presentation of research results on dam-breach outflow went well, especially with the participants from the Bureau of Standards and Corps of Engineers. He was invited to stop by Washington D.C. and visit the National Hydraulic Laboratory at the Bureau of Standards by its acting director Dr. Robert Dressler, what he did just before leaving by cargo ship for Europe.

Several months later Yevjevich received a letter from Dr. Dressler inquiring whether he may visit Avala Laboratory and see the model for study of unsteady flow in open channel. The answer was that Laboratory has asked authorities in Serbia for approval, which was granted, so Dressler came two times in 1954 and 1955 to visit Avala and Yevjevich. On a reciprocal dinner, Dr. Dressler asked Mrs. Yevjevich would she like to come to USA if her husband would be invited for 18 months on joint research. Her answer was affirmative. So the invitation came in 1956.
Yevjevich faced two giant problems: (1) will Serbian government grant visa not only to him but also to his wife and three small girls; and (2) Where to find 2000 U.S. dollars to pay for the trip to Washington D.C., since the invitation clearly stated that he was to pay expenses of going to Washington D.C. and the first month of living expenses until the first salary comes due.

HOW FINANCIAL PROBLEMS WERE SOLVED

Professor Yevjevich submitted his doctoral dissertation to the Serbian Academy of Sciences and Arts in 1955 and the same year the Academy granted him the degree of Doctor of Engineering. After being informed with the methods of investigation of water power in his thesis, the U.N. European Commission proposed to Yevjevich to give a course on it for four months in Bankok during May-August summer hot season. Yevjevich vacillated in decision until the invitation from USA came. Then he accepted the offer and gave the course by saving with a frugal life one half of four months salary. He deposited that money in a Swiss bank, reserved only for travel from Belgrade to Washington D.C. and the living expenses for the first month.

PROBLEM OF OBTAINING OUTGOINGVisa FOR ALL FIVE MEMBERS OF YEVJEVICH FAMILY.

The visa to leave country and leave of absence without pay for Yevjevich was not in question provided the member of family stays in the country. Yevjevich refused to accept the decision of Serbian Government. Then a long fight of nerves started. After returning from Bankok at the beginning of September 1957 Yevjevich stopped working as consultant of Electrical Power Authority in Belgrade, being "practically unemployed." It lasted until the beginning of February 1958, when the Deputy Minister of Interior Affaires of Federal Government invited him and his spouse and told them that the entire family will receive visa for travel to USA. Three cases of interchange of Yevjevich with the rulers of his country may be of interest to readers of this report.

When visiting with Secretary of Internal Affaires of Serbia, he told visiting Yevjevich “Even if we give you visa today, we can take you of the train and stop letting you live country.” Yevjevich answered, “I know that.” When visiting his schoolmate, who was responsible for the countries economy, he told Yevjevich, “if you go to Amerika, they will discover your value and you will discover Amerika, an ideal association.” Deputy Minister of Interior Affaires told Yevjevich “I trust you will not become political émigré.” “Even if I wished, I will not have time for it,” was his answer.

REASONS FOR WRITING REPORTS LIKE THIS BY AUTOBIOGRAPHICAL PRESENTATION

Basically three reasons are the most important: the professionals whose life is written about have the most reliable personal data; they are often incorrectly treated by the critics, since they usually have more enemies the better they are; and very often they are "neglected for political reasons" or families feuds. The professional of this report may state a very instructive case. The authers of the "Hundred years of Hydroelectricity of
Serbia," under the auspices of the Serbian Academy of Science and Arts, have published that book. Yevjevich, who was the most productive in the major theme of the book by both quality and quantity in the period 1944-1958, has been mentioned only once, and that one as the author of his doctoral dissertation.
Chapter 3

TIME SPENT ON DIFFERENT WORK FUNCTIONS IN THE UNITED STATES OF AMERICA FROM 1958 THROUGH 2003

1. Time from February 1958, is called here “Period of Serving Government of USA” it lasted until September 1960 (first 16 months at American University working for the U.S. National Bureau of Standards, the next 12 months until September 1960 with U.S. Geological Survey, Research Section of Surface Water Branch. This part will be subject of Chapter 4.

2. Time from September 12, 1960 to November 1979, called here “Period of Colorado State University,” he served in Fort Collins, Colorado for 19 years and two months. As Yevjevich has been compulsory retired at the age 65 years, he has been appointed part-time research associate, basically for summer appointments after the year 1979. This period will be described in Chapter 5. It is this period, which is characterized by three additional activities, which are needed in a guarded way, but if once properly conducted they may be very beneficial. They are: lecturing visits, participation in professional societies, and consulting. The role of each of the three activities is important for an advanced post-graduate program. In Chapter 5 it will be described how important they were for Yevjevich’s program at CSU.

3. Period of time from November 1979 to November 1987, a period of 8 years, Yevjevich spent as Research Professor at the George Washington University in Washington, D.C. (GWU). This was a small program, since there was only outside research money. In essence, some university leaders, considered the overhead part of research grants and contracts as income money, not only to cover the real overhead, but also to cover expenses, which would be difficult to cover otherwise. The work in this period will be described in Chapter 6.

4. Taking for the second time the official retirement, this time from GWU in November 1987, Yevjevich moved back to Colorado, but not to Fort Collins. For family reasons, he gave in to his wife to be close to the daughter with two grandchildren. So they moved to Highlands Ranch, in Southern Denver suburbs, a small community in being built. They learned later that U.S. contractors voted it as the best place to live in the USA. Period from 1987 to 1995 (8 years) Yevjevich considered as the Period of free-lance professional activities. Description is in Chapter 7.

5. The period from the arbitrary selected year 1995 to Yevjevich to change the way of using time for finally putting points on, so to leave less burden to children, wife, relatives, collaborators, colleagues, and friends. This will be described in Chapter 8, apart from description of professional activity.

FROM EUROPE TO THE WORK PLACE IN WASHINGTON, D.C.
Solving problems at destination prior to starting earning a living.
Yevjevich family embarked the Transatlantic Ship “Queen Elizabeth” in a French coastal city, and several days later, on February 10, 1958, reached New York City. The wavey surface Atlantic Ocean at that time of the winter kept family, two adults and three daughters, nearly all the feasible time in the swimming pool of the ship. The family was met in New York City by the Australian engineer Mr. Sutehrland, who with his wife and
two sons were doing in a private consulting firm what Yevjevich will soon start with U.S. Government. The Sutherlands, whom Yevjevich met at the hydraulic congress in Minneapolis in 1953, invited the four members of Yevjevich family to stay with them in Scarsdale, N.Y. until Father finds a suitable lodging in Washington D.C. The offer was accepted and that move created a friendship that resulted in years of exchange of visits. This invitation was welcome since Dr. Dressler has told Yevjevich that in no case will the U.S. Government reimburse the travel expenses and advance salary for the family needs.

Yevjevich took the train to Washington, D.C., to be met there by a very rare event, one-meter deep snow. He took a hotel room at the railroad station and first thing he did was to call Dr. Dressler’s home by telephone. His salary will start that same day, and he should report when Government will restart working, was the essence he got from Dressler. As soon as the traffic was re-established in the city, an employee from the cabinet of the Federal Secretary of Commerce, Mr. Strauss, came to hotel. He told Yevjevich he had come on the order of the secretary of Commerce for him to sign the first paper. Yevjevich naively asked “what paper?”, though he knew it from the discussion with Dr. Dressler. The employee’s answer was “to become citizen of the United States.” The final reaction by Yevjevich was: “Let me first discuss this aspect with Dr. Dressler.” The employee concluded visit by telling: “the position of director of National Hydraulic Laboratory may become citizen in 2-3 weeks by a special act of the Congress, because no foreign citizen may be appointed to leading positions in the Department of Commerce, if they do not declare at least the wish to become the U.S. citizen by signing the first paper.”

Dr. Dressler must have studied “Mr. Strauss’ problem.” He arranged with the Pentagon and American University, a private university in Washington, D.C., the following solution. The contract to study by computer the dam breaches flood waves, was to be done by the Bureau of Standards. The Bureau will pass the contract to the American University with the Bureau supplying to University salary of Yevjevich, overhead and access to 703 fastest available computers to Yevjevich. University Mathematics Department appointed Yevjevich research engineer and had to assure him of working space, secretary, and when feasible mathematical assistance. That did it. No more talks of director or the first paper.

**THE FAMILY HAD SETTLED IN WASHINGTON D.C. BY MARCH 1, 1958**

Yevjevich rented an unfurnished 3-bedroom house in the District. He equipped the entire house with the old but very inexpensive, workable and clean furniture and equipment. Thanks to a couple of American colleagues, from the District area, who have been the U.N. experts in Yugoslavia, and for who Yevjevich served as translator in important meetings, it was feasible to settle so simply and cheaply THE LOGISTICS OF TEMPORARY SETTLEMENT.
TIME AND RESEARCH ACCOMPLISHED FOR TWO U.S. AGENCIES

Period of time from February 1958 to September 1960.

1. Research executed and results obtained in working for and with the U.S. National Bureau of Standards by Professor V. Yevjevich during the period of time from his arrival in USA in February 1958 until August 1959.

1.1 Results of investigations on free surface unsteady water flow.

1.1 A. For regularly shaped two-dimensional canals the two de Saint-Venant partial differential equations are the best description mathematical model, whenever in numerical approach they can be applied and integrated.

1.1 B. For the other extremes, the very irregular three-dimensional channels, the basis for any approximate mathematical model, the simple water storage ordinary differential equation, should be used. Yevjevich gives an example in his published paper:


1.1 C. The computation of outflow water hydrograms (flood waves) through openings of breached dams may be either through openings, of via the entire dam destruction. It is considered as special result because of outflow being dependent on the characteristics of opening and the time function of making openings. Here the word hydrogram is used for discharge or level as function of time leaving the term hydrograph as the instruments for recording the flow wave passing through the orifices, openings, destroyed structures or entire dams. The Yevjevich's contributions to this topic are via papers, special reports or manuals:


1.1 D. Bibliography on unsteady surface water flow (including flood routing along the channels). Yevjevich has agreed with all the hosts for his research in the States on unsteady surface water flow, to work on the total coverage of bibliography (exhaustive approach). The first carrying to new research institution, has been this task, in this case from Bureau to U.S.G.S. Yevjevich
Prof. Dr. Vujica Yevjevich

has put enough efforts to design the way of presenting bibliographical references by all collaborating scientists and engineers. Following that principal, Yevjevich got supports from many collaborators. He was able to put large number of workers in a small activity area.

FLOOD ROUTING METHODS, Discussion and Bibliography, U.S. Geological Survey (Report), 1960, Washington D.C.


1.1 E. Manual for the completion of outflow hydrograms from the breached dams. This is done in such a way that any soldier of average intelligence may be able to use the manual. It has been designed as the method of 1, 2, 3... Though the manual is based on the theory of free surface unsteady water flow and its application, the necessary simplification and difficulties of application of an exact theory, both as the size and the time functions of creating breaches in dams by military means, as well as approximate analytically the complexities of three-dimensionality and the channel shape and channel random changing characteristic magnitudes. Yevjevich has been aware that his invitation to USA was basically been decided by the need of Pentagon. He has tried and succeeded to meet any demand and any level of sophistication of the manual. He has never been alone with the Pentagon officers who have been responsible to develop and test the manual. Yevjevich never asked the military, who have been very eager to discuss any problem of the floods of breached dams with him, to give him the manual for review or less so to have a copy of the final manual, though he has discussed with those officers every aspect of the final manual.

1.2 Structure of hydrological and in general geophysical time processes. Students of these series have limited themselves to a small number of observed stations, for two reasons the time was limited and with it the number of data represented the sample of a number of stations and the total number of research data requiring a large number of computation people. As the Bureau had the largest computer in existence, and Yevjevich has presented at AGU
conference in Rome in 1954 a paper on climatic fluctuations, it would be logical to permit him to use that computer for the study of geophysical processes by a great number of stations simultaneously. With the Rome paper Yevjevich became a very active member of a group of hydrologists around the world interested in the first place to be in the advanced research on space/time distribution of the geophysical space-time processes. Geological Survey was helping financially the investigators until the National Science Foundation started a very generous support.


PATTERNS IN SEQUENCE ON ANNUAL RIVER FLOW AND ANNUAL PRECIPITATION, Presented at the International Association for Scientific Hydrology (IASH) in Berkeley, California, September 1963, CER63VMY74.


MATHEMATICAL MODELS FOR TIME SERIES OF MONTHLY PRECIPITATION AND MONTHLY RUNOFF, with L. A. Roesner, Report prepared for the National Science Foundation, Hydrology Paper No. 15, CSU, October 1965.

FLUCTUATIONS OF WET AND DRY YEARS, PART II, ANALYSIS BY SERIAL CORRELATION, CSU Hydrology Paper No. 4, June 1964.


PATTERNS IN SEQUENCE OF ANNUAL RIVER FLOW AND ANNUAL PRECIPITATION, Presented at the International
Association for Scientific Hydrology (IASH) in Berkeley, California, September 1963, CER63VMY74.


MEAN RANGE OF LINEARLY DEPENDENT NORMAL VARIABLES WITH APPLICATION TO STORAGE PROBLEMS, Published in the Journal of Water Resources Research, American Geophysical Union, 3rd Quarter, 1967.


AN OBJECTIVE APPROACH TO DEFINITIONS AND INVESTIGATIONS OF CONTINENTAL HYDROLOGIC DROUGHTS, Report prepared for the National Science Foundation, Hydrology Paper No. 23, CSU, August 1967.


IV - 11
Period of time approximately from the middle of 1959 to August 1960.

2.1 Annotated Bibliography on Unsteady Water Free Surface Flow. Working in USGS Surface Water Branch, Yevjevich produced an extensive annotated bibliography (on interagency contract). That induced Yevjevich to study both input and output being complex but still predominately stochastic processes.

When Yevjevich started to work for the Bureau, the USGS scientists-hydrologists followed with great attention what methods he used and what results he got. It was then decided to invite Yevjevich for another term, this time to work within the USGS Surface Water Branch, Research Section. Apart from unsteady flow versatile research, the structure and modeling of hydrologic and hydro-meteorological time series was on the programs. Some special studies then were included in his work.

2.2 Misconceptions in hydrology and water resources and their consequences.
Yevjevich, on his initiative, studied what the basic conceptions underlined to several hundreds published papers, which have been hydrology and water resources oriented. To his surprise, he found six wrong axiomatic assumptions, which he called “misconceptions,” instead of wrong axioms, as the first version was called. The examples are maximum precipitation, as the computation with different variables can not occur for a small increment of the value taken in computation of “maximum precipitation.” Or, that the Great Lakes have such large volume of water as the natural resource of millions acre-feet to last as natural volume of water to supply humens with water for a very long time. This is a misconception for simple reason never they will be emptied. The following paper:

went through long opposition for a couple of years until three best U.S.
hydrologists (Luna Leopold, Walter Langbein, and Rolland Carter) stood for
publishing it...

2.3 Assumption that there is a relation between the hydrological time series
and sunspot time series. There is likely 500 papers published that claim the
dependence of droughts on the number of sunspots. May be, that another
similar number have been attempts which did not show any relation. The
review of papers by Yevjevich induced him to undertake verification of this
claim of dependence. He collected an enormous quantity of data on sunspots
and the corresponding hydrological and climatological data. He enjoyed
using the powerful computers, since they offered potential of fast processing
very large quantity of data in a short time.

Results of the study are given in two papers (see previously cited two papers
on sunspots). The highest correlation coefficient was around 0.10, with the
average close to zero. His position was “Neglect the sunspots when you need
to study and use hydrological data.”
1. How it occurred that from an 18 months invitation for join research to the immigration to the United States of America of Professor V. Yevjevich?

When Rector of the Belgrade University visited Washington D.C. by invitation as the guest of U.S. Government in early 1959, he invited Yevjevich to his hotel, and for three hours tried to induce him to apply for the advertised position of professor at Civil Engineering Department of Belgrade University. Though Yevjevich uneasily promised to apply and did it, with the result that the least qualified applicant, member of the party, was appointed by the Serbian rulers. Also, a letter by which Yevjevich repeated the offer to return under appropriate position was not even replied to. He understood that some rulers of Serbia did not want him to return. He then decided with his spouse and three daughters to immigrate to United States, especially under the urging of his visiting Mother to do so.

Yevjevich was asked often at professional meetings whether he was interested in a position at several universities. On his remark “you are kidding,” the answer would be “test us.” Colleagues from MIT and CALTEC especially repeated such informal inquiry. It happened that at that time professors from CSU (Colorado State University) invited Yevjevich to come to Fort Collins, Colorado to “measure us.” That happened at a meeting of a couple of hydraulic professors (at which Yevjevic, a Serb, served as an English/French translator, to an amaze of Professor Rouse from Iowa City, because Yevjevich was at home with English, French and hydraulics). As he has already made the inevitable decision to stay in the United States, since returning at that moment to Yugoslavia would be professionally suicidal. He accepted the invitation.

Visiting an Agricultural/Mechanical College, just couple of years earlier turned into University (only by name), 4,000 students, couple of hundred professors, 20,000-plus population of Fort Collins, and the small state population (around 3 million people to support several universities and many colleges), was not encouraging. In discussing the potential marriage, Yevjevich did not discuss salary or other privileges but three conditions of employment. They were: University to move for immigration status of family, University never to force him by any method to accept an administrative position (on he question why, Yevjevich’es reply was, to stay all remaining life engineer, scientist and professor producing good professional cadres), and three, to be free to raise research money wherever he thinks best. It was easy for the Dean of the College of Engineering to accept them. Later they realized that “Yevjevich has selected CSU and not only CSU
him.” Then in the summer of 1960 the “20 years of service and very productive life started.”

The three parts of the Yevjevich’s family, spouse, three daughters and himself, each found different environmental pleasing characteristics of the small town of Fort Collins, and differences from the similar small rural towns of the East or West Coastal areas of the United States. The family found an agreement within and inside decision-making process, the necessary and sound conditions for their new life and work. They have been fortunate with this selection of the place where to live, work or getting education. It worked for more than 20 years, practically from 1960 to the end of 1979, when Yevjevich had by Colorado law to retire from CSU, because he reached the retirement age of 65 years in 1979. He continued with summer appointments at CSU for finishing several research projects. The sequential presentation of the Yevjevich’s accomplishments was easy to be selected while he worked for well-structured and organized agencies of Washington, D.C. The presentation of results from the complex University environment, seem better by subjects, themes, and needs.


Yevjevich was very much surprised of how different concepts on the problems of risk existed within the U.S. governmental organizations in the 1950’s and 1960’s examples, at the two largest water resources oriented governmental agencies, that Yevjevich experienced (Crops of Engineers and Bureau of Reclamation) well served as examples. The two largest water related agencies will be described in this report because they may carry with them many consequences in the future.

Mr. Hathaway was the Corps of Engineers’ leading hydrologist, working in Washington, D.C., area. Senator Norris was the major force behind being the Senate’s chief promoter of building dams and reservoirs. He has put so many reservoirs into his State of Arkansas, that the joke went around that those mighty reservoirs in Senator Norris’s state will sink the the State (likely into the molten lava of the Earth crust.) In congressional debate on dams, special criticism went on flood risk to future building of dams and reservoirs. To prove that the other senators, who thought that risk existed and must be evaluated and taken into account in designing of large dams without taking into the account the “inevitable existence of risks.” Gumbel was invited to testify to Senate and the Chief of the Corps of Engineers. Gumbel was a European specialist in mathematical statistics, an immigrant to Canada, who has studied risks of nature, especially flood and drought risks. He had developed the Gumbel probability distribution functions of extreme values for these natural phenomena.
Hathaway invited Gumbel to prove to senators that there is no risk in their flood evacuation on “dams, and senators will not permit risks,” Gumbel replied: “Mr. Hathaway, you may hide risks, or you may neglect them, but you can never avoid them.” That story so much impressed Yevjevich that he used the first opportunity to accept a Tulsa Corps of Engineers Office offer to work for the Corps a flood study project as a consultant, which Yevjevich understood as description of floods by a modern concept on flood, by its probability, interpretation, and description of parameters, physical, explanation for the values of parameters, and other properties.

THE INSTITUTION OF WATER ENGINEERS, STATISTICAL THEORY OF FLOODS AND DROUGHTS, by E.J. Gumbel
(Reprinted from the Journal of the institution of Water Engineers, Vol. 12, no. 3, May 1958.)


This is in fact a very protracted duel between the heads of the planning, hydrological, sediment and ground water sections of the engineering service of the Bureau of Reclamation and the Hydrology and Water Resources Postgraduate and Research Program of CSU or, Mr. Reiter of the Planning Section of the Bureau and Yevjevich, as Professor-in-Charge of Hydrology and Water Resources Program at CSU. In late 1960s Yevjevich had the lunch, on his request, with the four section chiefs of the Bureau of Reclamation in Denver.

After formalities, Yevjevich stated the reason he asked for this meeting. It is the relation between giving jobs to doctoral engineering graduates and their employment possibilities. The dilemma is simple. Either we professors are teaching non-useable knowledge, and should be replaced, or the practicing engineers use the old and inappropriate knowledge and should be replaced. If you can relatively prove that all three important factors of a reservoir input, stored water and output, are clearly stochastic processes, and should be treated by applying probability concepts, stochastic processes and mathematical statistics, it would help the solution of above dilemma. We teach our doctoral candidates the most advanced methods in these areas. However, you refuse to hire them. What, according to your thinking, we should do? Stop producing them? Export them aboard? Try Private consultants, so they can outsmart you? Silence! Finally, Mr. Reiter interrupted it! And said “You cannot sell the probability, stochastic processes and mathematical statistics to me, and I cannot sell them to the Bureau of Reclamation.” Yevjevich, as he had expected that statement replied: “The only alternative left to us professors is to smuggle couple of hydraulic engineers- with doctoral degrees in the Bureau,
and you be surely surprised what powerful tools of water technology they have brought to the Bureau. And, Yevjevich just did it, he got a couple of such engineers, and when he saw a report on the Colorado River couple of years later, with the best statistical technology, he became very proud of his students, and doctoral candidates.

With keeping the good professional relations with smaller governmental agencies, and universities, where research programs included the applications of probability theory, stochastic processes and inferential mathematical statistics, especially using some principles, as trying to find physical justification or physical support to simpler stochastic models. The corresponding program created by Yevjevich at CSU got an excellent reputation in USA and worldwide. An example of simple result of bridging the stochastic and physical models is the First order autoregressive model (Markov first order model) of an aquifer or other storage body. If the outflow from the storage is simple two-parameter exponential function, the stochastic model must be the first order autoregressive model.

**FIRST IMPORTANT CONCLUSION IS:**
Yevjevich is proud that he participated in significant measure in introducing into the United State of America the application of the modern stochastic processes, supported by inferential mathematical statistics.

5. **EVALUATION OF THE MEAN ANNUAL FLOW OF THE COLORADO RIVER.**

The estimated river water passing the river gaging station at Lee-Ferry on the Colorado River at the border between upper and lower states of this river basin served and likely will continue to serve in the future, as the measure in dividing water between Colorado, New Mexico and Utah, which make the upper states, and Arizona and California and Nevada, which make the lower states. When the compact (agreement) between the two sides is made, the computed average flow at the Lee-Ferry station was taken as the amount of water to be divided equally between the upper and lower prosperous agricultural conditions, was first to import water from the Colorado River via grand aqueduct. Second in importance is the large diversion system of Colorado River to the planes of arid Arizona. Colorado has taken some water from Colorado River and mainly diverted it through the Rocky Mountains to its eastern slopes.

The computed flow at the Lee-Ferry soon became suspicious as overestimated, especially among the most advanced USGS hydrologists, regardless that the original first computation was made by the USGS staff.

By an increase in the number and quality of specialists in the country, related to hydrology and water resources planning, it was evident that the figure of
the average annual flow of the Colorado River at Lee-Ferry will be checked
by the most trusted professionals. Among those professionals, especially
trusted, was the famous US trio of best country’s hydrologists,
Liopold/Langbein/Carter. When Yevjevich, as professor at Colorado State
University, with the task of creating the most advanced program of the
research and postgraduate studies in water resources and hydrology at
Colorado State University, was asked to submit an offer to do the study as a
consultant, he consulted with the trio, though he knew that the reputation of
some USGS high-level positioned may come into question. They encouraged
him to pursue the study with the objective of producing the most accurate
value of that flow with the existing data and data which can be still obtained.
Being the visiting scientist-hydrologist for many months in the Research
Section of the USGS Surface Water Branch, he knew well the trio and on their
suggestion he submitted the offer and obtained the job as a private consultant.

Pages 20 and 24 of this report give the locations of three upper states
(Colorado, New Mexico, and Utah), as well as three lower states (Arizona,
California, and Nevada). It also gives the geographic position of the Lee-
Ferry water gauging station. The location of this station is also shown on page
24 together with the position of the Santa Clara County of California also
demonstrated.

5.1 RESULTS OF THE STUDY BY PROFESSOR VUJICA YEVJEVICH:

Professor Yevjevich took a couple of graduate students as study assistants,
collected all the available new data and started the investigation of quality of
collected data in form of systematic and random errors. He used up-to-date
methods of statistical analysis and those, which were available, and at the
known best performance. Both contents in information, in precipitation and in
runoff, used in trying to obtain the value of the pending second, namely,
maximum value of this second estimate of the flows of the Colorado River at
the Lee-Ferry.

The major results contributed by Prof. V. Yejevich were:

1. The new value of the long-range mean came out to be 20% lower than the first
   assessment produced for the compact.

2. According to much lower mean of water flow at the Lee-Ferry station, the use
   of Colorado River waters should be reduced to 40% for each side until the
   problem of difference in the available water in the Colorado River is solved.

5.2 CONTRIBUTION BY PROF. YEVJEVICH TO SOLUTION MINING
OF POTASH SALT IN SASKCHEWAN, CANADA

See page 23 for the map of the region of potash solution mining and page 24
for Yevjevich’s concept of dual cavity. The text starts on page 25 of this
report.
5.3 ESTIMATION OF 100-YEAR FLOODS IN SANTA CLARA COUNTY, CALIFORNIA

5.4 PARTICIPATION OF PROFESSOR YEVJEVICH IN SOLUTION MINING OF POTASH SALT IN SASKATCHEWAN, CANADA
A consortium company called Kalium Chemicals, with the seat in Denver, Colorado, USA. The objective was to mine potash salt by solution mining in Saskatchewwan, Canada. The mining involved an eleven meters thick one-mile deep deposit of near 50/50 potash versus ordinary salt.

The three engineers of Kallium Chemicals visited Colorado State University and met with eight CSU professors’ specialists in hydraulics, fluid mechanics, and hydraulic engineering. They discussed various problems related to solution mining. They left without making any statements on cooperation in the future. A couple of weeks had passed when Prof. Yevjevich got a telephone call from them, informing him that they would like him to be their consultant and if he agrees, he should come to Denver to discuss the relations.
The flow of Colorado River at Lee Ferry acts as the base dividing water between upper and lower states of the Southwestern USA.

Colorado River

Lee Ferry

Gauging Station
Area of Deep Layer of Potash Salt Deposits
Potash Salt Solution Mining
Autobiography

one cavity system

300 meters

pipe within pipe

50 m 50 m 200 m 50 m 50 m

dual cavity system

One mile deep, 11 meters thick layer of salt

Solution Mining of Potash in Canada
Yevjevich has served with that company as very successful consultant for several years. Yevjevich followed strictly the CSU rules for the consulting activity. The research in laboratory consisted of the permission for the use of one day per week on the average. Usually if possible to use only Saturdays, was thought best. Yevjevich has convinced CSU for the proposal of Kalium Chemicals at the CSU Foothills Hydraulic facilities were best used by contract.

Yevjevich divided all relations of CSU with Kalium Chemicals in two groups, work to be done on contract with CSU, and work to be done by private consultants, as Kalium proposed. To study solution process and form the first small cavity underground, big chunks of salt were taken from the deep wells, and brought to Fort Collins, Colorado for Prof. Barns to test all aspects of solution mining process on CSU/Kalium contract. In the same time Yevjevich tried to come out with the new technology of solution mining by introducing the concept of dual cavity solution mining.

Page 23 shows the approximate location of mining potash in Saskatchewan, Canada.

Page 24 of this report gives the simplified scheme of dual cavity concept of solution mining, which Yevjevich proposed, to Kalium. One cavity operation system one mile deep drilling for larger pipe is transferred to two pipes, with the smaller diameter pipe inside the larger pipe. Through the annulus between the large and the small pipe the water is force into the cavity and through the small pipe the brine is force to surface. The pipe-in-pipe system of classical solution mining means a significant drop in the hourly capacity to deliver brine to separation of potash.

The basic contribution by Yevjevich was the concept of dual cavity. The major problem to solve was how to connect two cavities, initially distant up to 300 meters. Yevjevich proposed two directional flexible pipes each directed to other cavity and by directional flexible pipes supply water by jets in the right directions. With all doubt initially by chemical engineers of Kalium, the system worked. Once connected cavities, the small pipes are taken out and water enters through the big cavity pipe and brine comes out to surface through the larger pipe of the other cavity. This increased significantly the productivity of dual system in comparison with two independent cavities. With some calculations by engineers involved the cost of extracted tone of potash has dropped from 100% to only 14% of unit price of the cost of one-cavity systems. Yevjevich considered that idia of his was the most remunerative contribution to industry of USA.
Determination of 100-Year Floods

Colorado River Main Flow Gauging Station

100-Year Flood Project
Santa Clara County, CA
5.6 CONSEQUENCES OF DUAL-CAVITY TECHNOLOGY

5.6.1. Non-discloser of dual cavity technology.

The leaders of Kalium Chemicals were highly impressed by the dual-cavity technology. They asked Yevjevich not to disclose to the third party anything about the new very good economy, about it without a written approval by the Kalium Chemicals, and Yevjevich and complied. When an English engineer tried to induce him to be consultant in solution mining of potash in the upper part of the Earth crust of the North Sea, Yevdjevich asked that engineer how thick is the salt layer; the answer was half a meter. Yevjevich told him “forget it” finished the discussion. One cannot exclude the end of the story. That engineer visited Director of Kelium Chemicals and likely got the same question and answer from the firm.

However, the continuation of investigations made the following advancements:

5.6.2 Use of brine saturated by NaCl salt instead of fresh water by solving more potash and less NaCl. The new set up permits the use of fully saturated NaCl salt, to be introduced into one cavity, then saturated with the potash solution penetrating deep into the salt ore deposits.

5.6.3 When the expansion reaches final stage, it is left with saturated NaCl salt and stop operation for sometime. There is deep penetration of brine into deposits until saturated by potash salt. Another economy. Such property makes dual-cavity long in operation.

5.6.4 Operation may be applicable even when one tries to fill cavities by stockpiled, ordinary salt on surface until it is due to be filled in. Another economy.

5.7 INCREASING THE SIZE OF CHRISTALS OF POTASH SALT BY MODIFICATION OF CRYSTALIZER.

The farmers who used the produced complained that the product they are buying and using is of too small average diameters. The engineers of Kalium Chemicals asked Yevjevich to find a modification to the existing crystaliser to produce much larger average diameter of crystals.

Yevjevich knew that it is difficult task for him. With his practical knowledge of hydraulics and fluid mechanics he found solution and increased significantly the average diameter of crystals, on the surprise of colleagues.

5.8 REDESIGN OF LIMESTONE KILNS IN CORPUS CHRISTI, TEXAS.

Once Kalium Chemicals felt how easy they got dual-cavity system, their appetite grew monthly. There they had the kilns for producing the baked limestone for the
use in several other manufacturing of chemical products. They simply told Yevjevich that the kilns have a problem, namely that the heat resistant bricks had only a life of about six months. Not only they had to purchase new bricks and install them, but they also had the loss of production of baked limestone during the work on new bricks. Though Yevjevich liked Corpus Christi and that part of Texas, also for very tasty red snapper dinners, the task was not defined clearly, with engineers of the firm expected that he will define the task by himself. And he did. He confirmed general knowledge on kilns. The larger permeability of limestone rocks in the kiln there was, the more and natural gas was attracted there, with higher temperature will tend to be there, and because it happened that the highest permeability was close to wall of kilns covered by bricks.

One of the reasons that the bricks burn fast and one knows how to change the average voids and distribution of voids within the kilns, it was easy to decrease the operational temperature close to wall, and thus the life of the bricks. It happened that the practical extension of practical length of bricks was to 2-4 times, depending on economic aspect of the new technology.

Yevjevich went to the congress of International Association of Hydraulics Research. Being elected in 1981 the honorary member of that Association, he proposed with explanations that their Association should extend hydraulics research to specific topics of mechanical and chemical engineers. The congress has voted unanimously that resolution.

5.9 DISCUSSION ON SOLUTION MINING OF COPPER. The appetite grows by eating. Yevjevich was asked by a couple of colleagues whether he would be interested in joint study of solution mining of copper. He asked three months of study before he would give him the answer. He got it, and when that time expired, his answer was a categorically “NO.” The major reason was that most mines of copper that the group planned to study had the average percentage of copper 1.5 to 3.3 percent. That would be difficult to get accessible by blast into such a porosity that would permit access to selected liquid for solution.

5.10 UNDERGROUND RETORTING OF OIL SHELLS. Similarly to copper Yevjevich got an invitation to work as consultant to a firm, which planned to test the idea of opening porosity in oil shells and fire oils accessible by air and out flowing oil now in liquid state. Simply, heat of burning oil will close fast the created porosity and thus making extinct many fires fast. The answer was also “NO.”

5.11 REVIEW OF SMALL PRACTICAL SOLUTIONS IN WATER RESOURCES ENGINEERING. Usually, the active university professors, specialists in water resources engineering, environmental affairs and water resources advanced planning, are often invited by communal leaders to help them resolve relatively new problems. Four of them, which happened to Yevjevich, will be reviewed here as examples of how he treated them.
(1) Evaluation of 100-year floods in Santa Clara County, California. One of those very busy days at CSU, Yevjevich got one of rare visits, the Director of Water Resources Service of the Santa Clara County, San Jose, California. He knew director casually when both worked for USGS in Washington, D.C.

The Santa Clara decided to defend each property in the County from the floods equal to or greater than 100-year flood, with 100-year flood defined as the flood that on the average happens once every 100 years.

The director was looking for hydrological specialist who can best but cheapest supply to County needed information. The condition that County required to be satisfied was that the best extraction of information in data on both precipitation and surface water observations be fully extracted.

An offer was made by using a new model of rainfall-to-runoff relation and neglecting the measured runoff, especially the 50 years of flow of small river Aroyo Secco. Director could not sign the contract, because USGS would not approve it, and the agency of the bidder stood firmly behind the bidder.

Yevjevich accepted the offer, signed the ready made contract, what director brought with him, and delivered the expected results on time. However, that was not the end of story. Often, when two institutions fight, the third party pays the price of it. For years Yevjevich has been the target of professional harassment on every occasion, regardless that he is nothing other done except use his right to compete in the professional services.

(2) Diversion of more water into a small river than their food waters. The example is water diversion in the Rocky Mountains from Westside to Eastside, from Dillon Lake to South Fork of the South Plate River. The normal diversion is a discharge equal to floods of the river. Three CSU professors: D.B. Simons, J. Gessler, and V. Yevjevich got assignment to change river characteristics to meet that situation, and they produced such results.

(3) Improving small rivers to increase the sport fishing river properties. The same three professors did that successfully.

(4) Case of increasing floods on small rivers by housing development. In a county in Washington, D.C. area, a developer first announced to build a house on an acre, no area less. People built accordingly. When developer announced to build houses on half an acre, two citizens went to court to stop the change. They claimed that increased impervious area would increase floods downstream and flood more often their houses. They asked Yevjevich to prove their claim. He went to Court with a very
simple proof in using only the data obtained from that development.
Developer immediately confided to be wrong.
6.1 PUBLISHING ACTIVITIES OF HYDROLOGY AND WATER RESOURCES PROGRAM OF COLORADO STATE UNIVERSITY. The policy that professor Yevjevich selected was there will be no firm policy. Every author will have the right to select the method of publishing the results that meets best the conditions.

6.2 COLORADO STATE UNIVERSITY HYDROLOGY PAPERS. It was felt by Yevjevich that the expected large postgraduate program in hydrology and water resources at CSU, the Program must have its own publishing capacity, at least such potential that it will cover the needs of publishing the various research products. Somewhere between sizes of papers usually taken as papers of referee journals, and small booklets. The average size taken by Yevjevich and his coworkers and students was the average size of CSU hydrology papers. Yevjevich was the author of 37 out of 100 papers, either as single author or as two or multiple author cases. He was also the manager and editor, but that was assumed to be (since nobody volunteered to take them), than appointed or elected. The list of 100 titles of papers is given in Appendix A-1 to A-14. The papers are still available for sale. The present manager and editor is Dr. Jose D. Salas, a professor of Hydrology at CSU. According to Dr. Andras Szollosy-Nagy, Director of UNESCO Water Division, the 100 hydrology papers may be already considered as “classical hydrology.”

6.3 PUBLISHED PAPERS BY YEVJEVICH. He has published until now various types of professional papers in total 198. One fourth or about 50 papers are produced and published during his very effective work in Yugoslavia, prior to moving to USA in 1958. The remaining 148 he produced and published during his life of 45 years in the USA. List of these 198 papers is given in Appendix A-1 to A-4. Published general professional books and proceedings books from different meetings are also given in Appendix A-5.

6.4 QUO VADIS AMERICA. Yevjevich wrote only one general non-technical book, QUO VADIS AMERICA (WHERE ARE YOU HEADED AMERICA?), a 264 pages book of synthesis of 42 years of observations of American society.

6.5 ACCOUNTING FOR WORK HOURS. It is rare that a professional of Yevjevich caliber spends each evening during 50 years of life to enter what he has done professionally during that day: how much time teaching, research, writing books and papers, preparing lectures, travel, etc. Out of 50 booklets, each having 12 sheets for 12 months, and 13th sheet for annual summary, the first 13 booklets relate to 13 years of a very professionally active life in Yugoslavia (1944-1957). Unfortunately they were victims of a fire at his sister’s apartment. The 37 annual booklets in USA, (1958-1995), are given as gifts to Civil Engineering Faculty of University of Belgrade at which he has studied for engineer (1932-1936), and taught hydrology and hydropower for 13 years (1944-1957). The University will
display booklets in the museum of Priboj, where Yevjevich was considered born. Yevjevich will get copy of 37 booklets, eventually for deposit somewhere in the United States.

6.6 TYPE OF WORK DONE AT GEORGE WASHINGTON UNIVERSITY. Period of time from November 1979 to November 1987, a period of 8 years, Yevjevich spent as Research Professor at the George Washington University in Washington D.C (GWU). This was a small program, since there was only outside research money. In essence, some university leaders considered overhead part of research grants and contracts as income money,

6.7 ADJUSTMENT TO AMERICAN SOCIAL STRUCTURE. By becoming U.S. citizens in 1966, his family and he have well integrated into the community of a small university town in the West, Fort Collins, Colorado, as well as in the American way of life. His eldest daughter Vera, finished accounting at the University of Colorado, Boulder, and is married to Bruce Maytum, a mechanical engineer. They live in Orinda, California, and she works at a Bank, San Francisco, California. His second daughter Branka, finished horticulture and landscaping at Colorado State University, and is married to Neil McLaughlin, a high school teacher. They live in Littleton, Colorado. She presently owns the Water Resource Publications. The youngest daughter Rada, finished accounting at the University of Colorado, Boulder, and got the M.A. degree from the London School of Economics, teaching for several years at the International University, Tokyo, Japan. She’s now teaching at the University of California at Berkeley, and managing the accounting at the University of Berkley. She and her husband, Brooks, live with their two children in San Francisco.

6.8 HELP BY U.S. COLLEAGUES. Report cannot be properly terminated without giving full recognition to Yevjevich as many colleagues in the United States who have been instrumental in Yevjevich’s coming to the United States, helpful in Yevjevich’s initial work for the U.S. National Bureau of Standards and the U.S. Geological survey in Washington D.C. He especially wants to recognize Yevjevich’s adjustment to a new academic environment fully enjoyable and productive.

6.9 INTERACTIONS WITH GRADUATE STUDENTS. Regardless of very dynamic and versatile activities while associated with Colorado State University found the interactive research work with his graduate students very stimulating. He always tried to induce them to benefit as much from their studies as their potential and the environment at Colorado State University could provide. The special emphasis was on making them independent thinkers and researchers, as well as responsible people with professional rigor and integrity. It was not always an easy or a pleasant task, especially asking the adult and mature young people to sweat for their own future good. The trust and intuition to stress on the future
potential for the late blooming students, rather than blindly leaning on the past grade scores, rarely failed him. His familiar approach was to personally interview the potential graduate students if at all feasible. Extensive lecturing travels and the attending of professional meetings have been useful in that regard.
VARIABLE ASPECTS, OFFERS OF KNOWLEDGE ON LARGE EVAPORATION

7.1 THERE IS INTEREST IN NSF AND NIH FOR FINANCING THE RESEARCH ON EVAPORATION FROM LARGE BODIES OF WATER OR SWAMPY LAND. The interest may be of how much of all rainfall on the Lake Victoria, Uganda, comes from the sea, say 30% while the 70% is returned water. If evaporates from the Lake, then the example is Amazonia. Studies have shown that only 20% of rainfall condensates into rain drops and returns to the Lake as rainfall. So rewarding from in many aspects to the profession of your country of Uganda. Four Ph.D. students from Yugoslavia under his advisor ship, with Colorado State University financially supported from research grants and contracts and several State University working toward their doctor’s degree (obtained later in Yugoslavia), have been contribution for making bridges between the people of Yugoslavia and the United States through an unselfish cooperation.

7.2 BUILDING A UNIVERSITY AND WATER PROGRAMS. It was necessary in 1960 land grant colleges just into a university by name but not yet by substance. Always felt proud of being one of many such builders during the last decades of association with Colorado State University. Soon, the Department of Civil Engineering entrusted with the task of creating a graduate and research program in hydrology and water resources. Several of jointly built good-quality, graduate and research activities in water resources area, one of the largest in the world. Yevjevich never asked for the position of full professor, or for or even for financial raises. All of them were given to him by the University as the recognition of the contributions to science, professional services and for building university.

7.3 CONTRIBUTION TO THE COUNTRY OF ORIGIN. It was also rewarding from an educator viewpoint to feel that you contributed in many aspects to the profession of your country of origin. Four Ph.D. students from Yugoslavia were under an advisor ship with Colorado State University and financially supported from research grants and contracts and several State University working toward their doctor’s degree (obtained later in Yugoslavia), have been contribution for making bridges between the people of Yugoslavia and the United States through an unselfish cooperation (joint interests).

7.4 INTERNATIONAL ACTIVITIES. International activities life in the United States was very productive in several aspects. Cooperation with the colleagues of the University of Catania (extended over 10 years, 1971-1981), University of Padua (lecturing twice at the International Postgraduate Course in Hydrology), and the many other organizations in Italy, were mutually beneficial to institutions involved. A large bilateral project on karst hydrology and water resources with
Yugoslavia sponsored by the U.S. National Science Foundation and the research funding sources in Yugoslavia, extended over an eight-year period, 1971-1979. A U.S.-Spanish project on conjunctive uses of various sources of water, sponsored by the Bilateral U.S.-Spanish Committee, year of activities.

7.5 It was necessary in 1960 to build a modern university from a small agriculture and mechanical land grant college, just into a university by name but not yet by substance. Yevjevich always felt proud of being one major such builders during the last decades of association with Colorado State University. Soon, the Department of Civil Engineering entrusted with the task of creating a graduate and research program in hydrology and water resources. Several of jointly built good-quality, graduate and research activities in water resources area, one of the largest in the world. He never asked for the position of full professor, or for tenure, or even for financial raises. All of them were given to me by the University in recognition of his contributions to education, science, and professional services and for building the university in general.

7.6 PROFESSIONAL ORGINIZATIONS. Activities in professional and scientific associations in the United States were basically related to the American Society of Civil Engineers as its fellow, American Geophysical Union (Section of Hydrology), and Sigma Xi, the international activities mostly covered the International Association for Hydraulic Research (by attending its 14 out of 19 congresses, and serving twice as the Council’s vice-president with honorary membership awarded at the Congress in New Delhi, February 1981), the International Association of Hydrological Sciences, the International Water Resources Association.

7.7 EDUCATIONAL ACTIVITIES. In education, taught mainly the graduate courses in hydrology (application of probability theory, stochastic processes and mathematical statistics to hydrology and water resources), wrote and published a large number of papers and two books on these subjects. Guided about 50 Ph.D. and 50 M.S. students, as their major professor, adviser and chairman of their graduate committees. The were published in the 100 hydrology papers of Colorado State University in the period 1963-1980, of which he was editor and one of the major countries of all continents. As many of them are at very high academic and professional positions, and are leaders in their disciplines in many countries of the world and in the United States.

7.8 CONSULTING ACTIVITIES. Consulting services at the highest professional levels, both in the United States (to governmental agencies, private corporations) and in many foreign countries, kept continuously in contact with practice that made well-aware of evolving professional problem areas that needed scientific research efforts. They helped generate new research ideas, both for his personal research efforts and for Ph.D. and M.S. these of graduate students under his advisor ship.

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7.9 BILATERAL MEETINGS. Bilateral symposia, most often initiated and organized by such as the U.S.-Japan seminar on systems approach to hydrology, the U.S.-Yugoslavian symposium on karst hydrology and water resources, the U.S.-Argentinean workshop on droughts, and others, are examples of further international cooperation. He was instrumental in bringing to Colorado State University the 1967 Congress of International Association for Hydraulic Research, and the three international symposia in hydrology (1967, 1972, 1977), apart from several summer short courses and institutes that it be organized.

7.10 LECTURING AND ADVISING VISITS. Lecturing tours or short visits with lectures, included: Australia (four times), New Zealand, Thailand (several times), India (several times), Taiwan, Philippines, Indonesia, Japan, Lebanon, Tanzania, Uganda, Ethiopia, Republic of South Africa, Kenya, Brazil (several times), Argentina, Peru, Colombia, Venezuela, Mexico, Canada, Sweden (several times), Netherlands (several times), France, Italy, Yugoslavia, Hungry, Turkey, Poland, Spain, Portugal, Great Britain, Federal German Republic, Austria, and others. In 1971 he spent three months as the Fulbright scholar at the Technological Institute of the University of Lund, Sweden, delivering a full course on stochastic hydrology. In 1974, that university awarded Yevjevich the degree of Doctor Honoris Causa. In 1974 gave a full stochastic hydrology course at the University of Sao Paulo, Brazil.
Chapter 8

8 ONE OF THE MAJOR CONTRIBUTION BY YEJVICH (According to two Serbian professors of water resources engineering and hydrology, Dr. Branislav Djordevic and Dr. Zoran Radic of the University of Belgrade) is the concept TIPS or T-I-P-S. The four letters in the composition TIPS mean TENDENCY, INTERMITENCY, PERIODICITY, and STOCHASTICITY. They represent, according to Yevjevich, the four basic properties of geophysical time series.

8.1 TENDENCY relates to parameters of geophysical series, such as the mean, variance, autocorrelation parameters, etc. Let assume one wishes to study floods of the Danube River at Orsova, Rumania. The mean has been changing appreciably during the last 300 years. When the process of building large systems of flood control levees started (the advent of the vapor machine) the polders behind the levees were not filled by floodwaters, and floods increased downstream flood peaks. WITH the age of building levees reversed and mean flood started to decrease, because the floodwaters were needed to fill reservoirs.

8.2 INTERMITENCY. This property of stochastic time processes is well known. Such expression as random character of Yevjevich had studied sequences of drought. These are processes.

8.3 PERIODICITY. With commensurable frequencies of harmonics infrared process. The estimated frequencies are not commensurable, are classical fits of periodic or almost periodic fits.

8.4 STOCHASTICITY. (randomness) treated in the TIPS model as it is defined in the most advanced books on probability theory.
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I. General Books / Author

1.1 Water Control Scheme, a book on water resources development (in Serbian): Novi Sad, Yugoslavia, 1946.

1.2 Investigation Methods of Water Power Resources, thesis for degree of doctor of engineering sciences, February 1955, the Serbian Academy of Sciences, Printed 1956, Beograd, 1956 (in English and in Serbian).

1.3 Water Power Resources of Yugoslavia, Beograd, 1956 (in English and in Serbian).

1.4 Hydrology, I Part (in Serbian), Beograd, 1956


II. Editor of Proceeding Books


III Published Papers


5. Dissipation of energy of overflow waters by means of forced jumps (In Serbian), Communication to the first meeting of Yugoslav specialists on large dams, Beograd, 1951.


7. On General Geologic conditions for the creation for water storage reservoirs in Dinaric mountains (in Serbian), Journal Elektroprivreda, No. 5-6, Beograd.

8. Some special features of designs and construction of earth dams and rock fill dams in Yugoslavia, with B. Rajcevic (in English), Report to the Fourth International Conference on Large Dams, New Delhi, India, 1951, printed also (in Serbian) in Proceedings of the first conference in Yugoslav Specialists on Large Dams, Beograd, 1951.


18. Entrainment of air in flowing water and technical problems connected with it, with L. Levin (in English) Report to the International Conference of Hydraulics (IAHR), Minneapolis, USA, 1953 (Proceedings Minnesota International Hydraulics Convention, Sept. 1-4, 195); Printed also in Serbian, Beograd, 1954.


31. The Possibilities to increase the annual production of the group of water power plants Mavrovo – Polog (in Serbian), Journal Elektroprivreda, No. 1957, Beograd.


34. Analysis of the general scheme and the reasons for adopting for waterpower Jablanica (in Serbian), Journal Elektroprivreda, No. 1, 1958, Beograd.

35. The problems of water power economics of Kosovo and their general solutions (in Serbian), Journal Elektroprivreda, No. 3, 1958, Beograd.


37. The general problems disposal of sewage waters: with the special attention of the problems of the rivers and sewage disposal in Yugoslavia (in Serbian), Journal Izgradnja, No.1, 2, 3-4, 1958, Beograd.

38. General aspects of the water and waterpower resources in Yugoslavia (in French), Swiss journal Wasser-und Energiewirtschaft, No. 5-7, 1958, Zurich, Switzerland.


45. Climatic fluctuations studies by using annual flows and affective annual precipitations, paper presented at the international symposium or Climatic Changes, Oct. 1-8, 1961, Rome, Italy, CER62VMY42.


49. Fluctuations of wet and dry years, Part. 1, research data assembly and mathematical models, Report prepared for the National Science Foundation, hydrology paper No. 1, CSU July 1963.

50. Fluctuations of wet and dry years, Part II, analysis by serial correlation, CSU Hydrology paper No. 4, June 1964.


52. Patterns in sequence of annual river flow and annual precipitation, presented at the International Association for Scientific Hydrology (IASH), in Berkeley California, Sept. 1963, CER63VMY74.


57. Rate of change for the peak for floods progressing along a channel, paper presented at the International Association for Hydraulic Research Congress, August 1965, Leningrad, USSR, CER65VMY58


73. Mean Range of linearly dependent normal variables with application to storage problems, published in the Journal of Water Resources in Research, American Geophysical Union, 3rd quarter 1967.


75. The investigation of relationship between hydraulic time series and sunspots numbers, with Ignacio Rodriguez-Iturbe, Report prepared for the National Science Foundation, Hydrology paper No. C-6, CSU; April 1968.


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77. Effects on truncation on dependence in hydrological time series, with Rezaul Karim Bhuiya, report prepared for the National Science Foundation, Hydrology Paper No. 31, CSU, Nov. 1968.


84. Application De Las Runflas A Las Series Hidrologicas, with Jaime Saldarriaga, Proceedings of the IV Congreso Latinoamericano De Hidraulica, IAHR.

85. Relacion Entre La Estacionaridad de series hidrologicas y los ciclos existentes en ellas, with Ignacio Rodriguez-Iturbe, Proceedings of the IV congreso Latinoamericano de Hidraulica, IAHR.


94. Stochastic structure of water use time series, with Jose D. Salas- La Cruz, Hydrology paper No. 2, CSU, June 1972.

95. Structural analysis of hydrologic time series, Colorado State University, Hydrology paper No. 56, Nov. 1972.


100. Stochastic processes and models in hydrology, section 4, hydraulic system modeling techniques and services, proceedings of the second International Seminar for Hydrology Professors (supported by NSF and UNESCO), Utah State University, pp. 109-170, August, 1974.


110. Input data needed for water resources systems analysis, the general report on the 16th IAHR congress, Sao Pualo, Brazil, July- August 1975 (published in the congress proceedings book).


112. Influence of simplifications in watershed geometry in simulation of surface runoff, by L. J. Lane, D.A. Woolhisier, Vujica Yevjevich, December 1975, Colorado State University, Hydrology paper No. 81.


122. Effects of forest and agricultural land use on flood unit hydrographs, by W. Sangvaree and V. Yevjevich, Colorado State University, Hydrology paper No. 92, July 1977.

123. Fluctuations of wet and dry years, an analysis by Variance Spectrum, by V. Yevjevich, Colorado State University, Hydrology paper No. 94, August 1977.


141. Stochastic properties of water shortage (with G. G. S. Pegram, J. D. Salas, and D. C. Boes), Colorado State University, Hydrology paper No. 100, Aug. 1980.


163. The risk factor in water resources, Proceedings of Engineering Foundation Conference on “Risk Based Decision Making in Water Resources,” held at Santa Barbara, California, Nov. 3-5, 1985, and published under the same name by the American Society of Civil Engineers, pp. 129-140, Oct. 1986.


177. Living With Diversities and Coping with Complexities of Hydrology; Proceedings book “Catchment Runoff and Rational Formula” (Edited by Ben Chie Yen), WRP, PO Box 2841, Littleton, CO 80161, USA; p. 1-17, 1991.


192. Availability and selection of sources of water for water supply systems, paper jointly presented with T.G. Sanders at the NATO Advanced Study Institute, and printed in the same proceedings book as described under the entry 191 of this list, except on pages 25-41.

193. New concepts for water supply systems, “What Kind of Water for What Purpose in the Future”, paper presented at the NATO Advanced Study Institute and published in the same proceedings book as described under the entry 191 of this list, except on pp. 43-57.

194. Pollution for urban water supply systems, paper jointly presented with T.G. Sanders at the NATO Advanced Study Institute, and printed in the same proceedings book as described in entry 191 of this list, except on pp. 59-70.

195. Wastewater Reused-A Worldwide Issue, paper jointly presented with T.G. Sanders and Lisa M. Dunn at the NATO Advanced Study Institute, and printed in the same proceedings book as described under the entry 191, except on pages 71-84.


199. A talk on large dams at addressing Serbian Symposium on large dams at Kladoos, Serbia, on October 8, 2008 by Vujica Yevjevich.

200. The speech by Dr. M. Vukobrabavic, President of Yugoslavia Academy of Engineering, on due 90th birthday of Dr. Vevjevich on October 13, 2003 at the University of Belgrade, Civil Engineering Faculty, published in Serbian magazine "vodopravda," in Belgrade.
Prof. Dr. Vujica Yevjevich

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Vujica Yevjevich
Biographical Portrait for Monograph on Members of the Yugoslav Academy of Engineering.

Part 1: Life Events

Dr. Vujica Yevjevich was born on October 12, 1913, in Southwestern Serbia, in the village Kasidoli, the district of the city of Priboj. In 1919, his parents, Father Mihailo Jevdjevic, priest of the Serbian Orthodox Church, and Mother Darinka Jovanovic, housewife moved to the city of Priboj, in the new seat of the Parish. He finished primary school in 1924, the eight-years high school (gymnasium) in Sarajevo in 1932, and obtained the Civil Engineering degree in 1936 from the Belgrade University, which was done in four years with top grades. He graduated from the School for Reserve Military Officers in June 1937 and thus became the reserve officer of the Yugoslav Army. After the free-lance work for six months in Belgrade, mainly as a civil engineer, he got the job in the Technical Division of Administration of Vardarska Banovina (the approximate territory of the today’s Republic of Macedonia).

With the degree in civil engineering, the scholarship from the Government of France for a year enabled Yevjevich to obtain also the degree of hydraulic engineering in June 1939 in Grenoble, France. The news of declaration of war by Great Britain to Germany on September 1, 1939 reached Yevjevich in London at the end of visits of hydraulic laboratories in England and Scotland. The three aspects of the program of study were: concepts underlining the establishment of each laboratory; hydraulic problems being solved on hydraulic physical models; and doing hydraulic research on models first built and used in solving specific problems. He returned to Skoplje, where an appointment for chief engineer of Technical Unit for Regulation of the channel of the Vardar River was waiting for him to return.

Occupation of Yugoslavia in 1941 by Germany and her satellite states, made Yevjevich prisoner of war. He spent 9 months in four camps in Germany (April-December 1942), and 21 months in three camps in Italy (December 1941-September 1943). Once Italy was out of war in September 1943, that situation enabled him to leave the prisoner camp of Cortemaggiore in Northern Italy and to reach Rome, where he lived in hiding for 9 months. When allied forces liberated Rome from Germans in June 1944, they transported some Yugoslavs, ex-prisoners of war – including Yevjevich – to island Vis, which at the time was seat of the Professional Yugoslav Government. Yevjevich was assigned to unit for planning reconstruction of destroyed cities during the war in Yugoslavia. After Belgrade was liberated from the Germans, he was flown to Belgrade by Air Force in November 1944.

Yevjevich had a very intensive professional carrier in Belgrade, which lasted 14 years (1944-1958). He was consultant to Federal Ministry of Public Works. On request, he was transferred to Serbia with the task of forming and leading Hydrobureau. This was an organization for study, planning, design and supervision for construction and operation of water resources development projects. He was director of a central organization for planning and design of hydroelectric power plants. For that task, he was twice decorated for good professional work. He was director of water resources research institute for several years. In 1956 he became consultant to Yugoslav Agency for Electrical Power.

The U.S. National Bureau of Standards invited for eighteen months joint research in Washington D.C. Yevjevich went to USA as visiting guest. Scientist in February 1958,
accompanied by his wife Mirjana and three daughters: Vera (8), Branka (6), and Rada (3). He spent as research scientist with the Bureau and with the Water Resources Division of the U.S. Geological survey twenty months, from February 1958 to September 1960. When in 1959 the Government of Serbia ignored Yevjevich's offer to return to Yugoslavia and to serve the country, he didn't get a response. That government even intervened against his election and his selection for professor at the Belgrade University, though he was much better qualified for that position than any other candidate. He then decided to except a position at Colorado State University, Fort Collins, Colorado, USA., and to immigrate to USA. He spent 19 years at CSU as professor in charge of graduate and research program in hydrology and water resources, from September 1960 to September 1979. After compulsory retirement at 65 years of age in state universities in Colorado, Yevjevich was appointed research professor at George Washington University, the Private University in Washington D.C. After 8 years, in November 1987, he retired from GWU to Colorado. In the Past 14 years (1987-2001) he was very active in consulting, writing books and scientific institutes, performed in both USA and Europe.

Part II. Yevjevich's Life Activities and Accomplishments.

1. Period until 1937. He finished all schools on time with highest grades.

2. Period 1937-1941. In Macedonia he acquired important practical experience in collecting research and design data, in design, construction and operation of various water resources structures and projects, regardless that they were of relatively small dimensions.

3. Period 1941-1944. In 30 months in prisoner camps and nine months in Rome, he studied languages and about 100,000 pages of professional books in German and Italian. Those efforts and necessary discipline turned out to be very beneficial to him, may be much more of a new degree.

4. Period 1944-1958. Immediately after the war, in 1946, he wrote the book “Water Resources Scheme,” with the major objective of presenting presenting concepts in working on river basin water resources development schemes. It is considered even today an up-to-date book. He participated in almost all final shadings of the river basin water resources schemes and hydroelectric power projects in Yugoslavia, especially in her Eastern Part. For some of them, he was author and so-author, and had to prove that his solutions are among the best if not the best. For some others he was in the opposite position committee. Preparing himself as much as he could squeeze the time for it, both by basic and applied types of review criteria and arguments, it was not surprising that he dominated the review process in schemes and projects in the decade 1946-1956.

He was major force in generating concepts for creating and operating the Avala Hydraulic Laboratory. He was the first hydraulic engineer to receive doctorate in 1955 from the Serbian Academy of Sciences and Arts. His thesis was “Methods of Investigation of Water Power,” a novel approach. He produced the monumental book “Water Power of Yugoslavia” in Serbian and English. He wrote the first book on hydrology in Serbian language and introduced it as the first course in hydrology at the Belgrade University; he was its first lecturer. He was also first to introduce the course “Utilization of Water Power; he was its first lecturer at the Belgrade University. He guided more than 70 diploma-working students, more than nearly all the other water resources professors together, at that time, though he was only an honorary professor from 1946 to 1956. During this time he published almost 40 papers related to his

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research of applications of stochastic processes in hydrology, hydraulics, and other subjects. His evidence for 37 years of how much time he spent as a professional, it shows nearly the double regular office time.

5. Period February 1958-November 1987. This period produced the large book in three volumes on unsteady flow in open channels, with Yevjevich the senior editor and one of the major contributors. Papers are published on open channel flood waves created by dam breaches. Research is done on time series in hydrology with many new stochastic models. To the Milankovic'es orbital, periodic or almost-periodic astronomical time series, Yevjevich added three more components: tendency in parameters (say like the mean standard deviation, the autocorrelation coefficients, which change with the change of time); intermittency and others (such as the yes/no process in time series; and stochasticity (like random change in the series values). He named this model "The Tips-Model." Any geophysical time series is composed of 2-4 components only. He developed one of the largest and the best graduate programs in advanced hydrology in the World.

At this time at CSU, more than 50 graduate M.S. and Ph.D. students from all around the world were majoring in hydrology. Besides the hydrology, the Program has been developing the new, advanced methods for solving the most complex problems in water resource developments.

At times during his tenure, the following two activities were on the order of the day: consulting and organizing with the European colleagues the NATO advanced study institutes and research workshops. The two major aspects have dominated the problem of the non-military NATO Scientific and Environmental Affairs Division: (1) the cooperation between the NATO countries and the Eastern European countries; and (2) solving some difficult environmental problems. Yevjevich, with his long and versatile experiences in both, has been useful to that Division in these subjects. One of the contributions is the pending publishing of the book "Water Environment", resulting from a research workshop sponsored by that Division. Yevjevich was one of the directors, the senior editor of the book out of the four editors, and the contributor of a chapter. In it, Yevjevich is explaining why the U.S. contractors voted Highlands Ranch, Denver, Colorado, the best community to live in of all the other communities in the continental USA. Yevjevich, with the keen sense in observing the life in the USA in more than 40 years wrote and published in 1999 the 264 page-book: QUO VADIS, America? (Where are you headed, America? This is the only non-technical book he has written and published.

He will celebrate the birthday at 88 years on 12 October 2001, 65 years of professional scientific and engineering work, 42 years of teaching and doing research at three universities, delivered about 75 special courses in about 50 countries, many of them on the application of stochastic processes and mathematical inferential statistics to the use and control of water resources, but especially to the applications to the advanced hydrology, for the most rational water resources developments.

Dr. Yevjevich has been asked by the local museum in his native city of Priboj to display his memorabilia in that museum, including 30 professional awards from all around the world. He has agreed to give as gifts all memorabilia to the Belgrade University. The University will then loan them to the Priboj Museum for current display, with the agreement clause that those memorabilia may be safeguarded in the Uzice
Museum by the order of the Belgrade University of any trouble may put memorabilia into jeopardy.
Autobiography

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HP4 Fluctuations of Wet and Dry Years, Part II, Analysis of Serial Correlation by V. Yevjevich, 1964.


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HP94 Fluctuations of Wet and Dry Years, and Analysis of Variance Spectrum by V. Yevjevich, 1977.


Autobiography
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Contributions by Professor Vujica Yevjevich to Water Resources Development of Serbia and Montenegro, Macedonia, and Bosnia and Herzegovina

Part V

Report obtained by autobiographical presentation

Section V-1: Serbia and Montenegro
Section V-2: Macedonia
Section V-3: Bosnia and Herzegovina

Highlands Ranch, Colorado, August 2005
CHAPTER 1

THE ROLE OF PROFESSOR VUJICA YEVJEVIC IN WATER RESOURCES DEVELOPMENT OF THE REPUBLIC OF SERBIA AND MONTENEGRO

Influence on water resources development in the periods 1938 to 1944, and period 1958 to 2005, with the essential influence in the 14 years period 1944 to 1958.

These influences of various importance range from the practical hydraulic engineering contributions to the most theoretical, experimental and research contributions in water sciences, both theoretical and applied water resources engineering and water economy. He was active either in the creation of the new water resources systems or in the operation and improvement of existing systems.

His versatile experience in hydraulic engineering started in Belgrade in the summer of 1937, though his students’ summer 1935 short-term employment was in the construction of new highway Novi Sad – Subotica. It represented the first contact with the hydraulic problems of highways, by being located at the Feketic section of the highway.

The real beginning of serious engagement in practical hydraulic engineering started in the summer of 1937 when the hydraulic engineers of the Ministry of Public Works in Belgrade started to look for a young graduate from the Civil Engineering Department, Hydraulic engineering orientation for the two assignments:

1. To fill the opening in the Technical Service Offices in Skopje, the present Macedonia, as the responsible engineer to study the regulation of the channel of the Vardar River through the city of Skopje and the about 30 kilometers of the meandering Vardar River through the Skopje Plain; and
2. Parallel to it, to study river meandering as the prevalently a random process, with the selection of the technique how to regulate most economically the channels of rivers flowing through plains created by the river sediments (this was the first time Yevjevich came to term “random processes”, which will have an important role in his future professional life). He accepted the offer by the Ministry and was appointed engineer in Skopje, starting the first regular job the first December 1937. This period December 1937 – November 1944 is described in the report of Yevjevich’s contributions to the water resources developments in the Republic of Macedonia, and in the reports which covers the activities during the war years 1941 to 1944.

In the further text the contributions to water resources development in the Republic of Serbia and in the Republic of Montenegro will be presented here in a summarized from
since there is a detailed report of 29 pages in Serbia language. In practical terms, there was nearly any important water resources problem either in the Republic of Serbia or in the Republic of Montenegro that Yevjevich did not tackle one way or another in the period November 1944 to February 1958. A special emphasis was given to river basin water resources planning. These basic documents then served as the basic of selecting the specific project of hydroelectric power plants, reservoirs and dams for storage of water for water supply and irrigation, flood or drought control structures and others, to be designed and submitted for approval for eventual construction.

CHAPTER 2

WORK IN REPUBLIC OF SERBIA IN THE PERIOD
NOVEMBER 1944 – FEBRUARY 1958

After the demobilization in November 1944 and arriving from Island of Vis in Belgrade, Yevjevich served a short period of time as the advisor to Minister of Federal Ministry of Public Works. On the request of the Government of the Republic of Serbia, he was transferred to that Republic, with the task to form an organization for water resources development. Thus the Hidrobiro was borne.

It was not easy for him to start that organization. It was difficult to find a necessary sufficient numbers of competent technical personnel, especially civil engineers with good experience in hydraulic disciplines. Also, they have not enough modern technical literature in Serbian language to help this young people to be productive. So, Yevjevich made several crucial decisions in order to help solve the problems posed to him.

First, he decided to write the book on hydrology, conceived by him as the basic science for the objectives of the Hidrobiro and to teach hydrology at the university. Thus, he introduced two new courses the hydrology and the water power development at the Civil Engineering Department (Faculty) of the Belgrade University, and agreed to teach them as the honorary professor. In this years period of 14 years he graduate 70 diploma hydraulic engineers. In that way, he filled all vacancy in his Hydrobiro, but also Serbian and Yugoslavian need for hydraulic and hydrological engineers.

As it conserves the technical literature, he did two basic things:

1. He selected Russian technical books, most convenient to Serbian needs, and advised students to use those books since it was easy for Serbian students to read those books.

2. He didn’t only write a book on hydrology, but also he wrote some notes for students on water power development. However, he decided one day to write a new book called Water Resources Development (Vodoprivredna Osnova, in Serbian language).
One day in 1946, he took 7 days leave of absence without pay, took a Cyrillic typewriter and went to thermal bath place called Vrnjacka Banja. There he wrote in seven days 77 pages booklet on water resources development. Then he published it in Novi Sad in 1946. That booklet served as the guidance for working river basin planning of water resources development throughout Serbia, Montenegro, Bosnia, Herzegovina and the other parts of Yugoslavia.

TO BE CONTINUED
LONG-RANGE GENERAL PROGRAM FOR RESEARCH IN
BASIC AND APPLIED HYDROLOGY

This Program is compiled by Prof. Dr. Vujica Yevjevich
in the year 2005, especially in view of creation of
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Part VI

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**PART VI**  
**IDEAS FOR BASIC AND APPLIY RESeRCH IN HYDROLOGY FOR THE IMMIAL FUTURE**

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CHAPTER VI-A

INTRODUCTION TO GENERAL PROGRAM OF RESEARCH IN HYDROLOGY

Section VI-A-1. Hydrological environments

VI-A-1.1 Environment description. Each Earth environment contains water problems, which must be investigated. When they have those characteristics, their environments may have either specific hydrology-related names or a description by using a set of two or more words.

VI-A-1.2 Basic hydrological environments. These environments are:

1. Atmosphere, with its water related branch called hydrometeorology.
2. Oceans and seas, with their hydrology related properties, often called oceans currents or sea surface and bottom disturbances.
3. Continental water environment, often called continental hydrology.
4. Underground waters environment, often called geo-hydrology or hydrogeology.
5. Environmental quality of water, usually called water quality hydrology.

VI-A-1.3 Specific environments. These specific environments may be looked at from the point of their view of research areas as related to water. The research topics may be sorted in two groups of topics:

1. Topics specific to that environment, and
2. Topics of interest to both, to that environment as well as any of the bordering environments. In this program of research topics, hydrology will be conceived as a geophysical science with very strong aspects of hydraulic and environmental engineering.
CHAPTER VI-B

GENERAL PROGRAM OF RESEARCH TOPICS IN HYDROLOGY,
GROUPED BY CRITERIA OF AFFINITY OF TOPICS

Section VI-B-1. Sorting of times affinity groups

VI-B-1.1 List of groups. The list of groups, with the names of groups, the numbers of topics and the total number of topics in the group, are given in Table 1:

GROUP A
Contains research of topics on hydrological space/time related processes, influenced by the tectonics of Earth plate tectonic movements.

GROUP B
This group of research topics is composed of hydrological space/time/processes of surface water resources and environmental problems.

GROUP C
With topics belonging to hydrology of karstified carbonate rock formations.

GROUP D
This group of research topics covers hydrology of surface or subsurface water storage reservoirs, man-made or created by natural processes.

GROUP E
This group of research topics contains topics which are related to flood control and solutions of drought problems.

GROUP F
This group of research topics covers topics that are related to production of sediments, their transport by wind and rivers, and deposition in lakes, rivers and seas, all conceived as related to hydrological processes.

GROUP G
This group of research topics is groundwater related, in light of both, geohydrology and hydrogeology.

GROUP H
This group of research topics covers water quality, especially in connection with solution of problems in environmental and sanitary engineering.
GROUP I
This group of research topics covers special topics related to particular applications of probability theory, stochastic processes and inferential mathematical statistics in hydrology.

GROUP J
This group of research topics covers unrelated topics as remaining topics in this program.

CHAPTER VI-C
A – GROUP OF RESEARCH TOPICS

Section VI-C-1. Relationship of Earth plate tectonics on hydrology

VI-C-1.1 Tectonics on influence of hydrological characteristics. The Earth’s plate tectonics have large influence on characteristics of continental hydrology. Very little attention was given in the past to it by the researchers of hydrology.

VI-C-1.2 Describe general themes in the group A on Earth surface. Here, it is covered by several research topics as the group A, of which the most general themes are described as follows:

1. Plates are pushed one against the other in such a way that one plate at the contact is lifted above and the other is forced below the level at which they were before the break. They may be characterized for hydrological purposes as orographic lifting and depletion subsiding, respectively.

2. Plates are pushed away from each other, thus creating the break in the crust, producing phenomena known as "Spreading of Continents" with various effects on continental hydrology.

VI-C-1.3 The first case presented. The first case will be presented here under the title RESEARCH TOPIC 1: Influence of subsidence and lifting of earth crust in hydrological phenomena on continents.

VI-C-1.4 The second case presented. The second case will be presented under the title RESEARCH TOPIC 2: Influence of spreading of continents on continental hydrological characteristics.
Section VI-C-2. Research topic A-1

VI-C-2.1 Influence of subsidence and lifting of earth crust plates on hydrological phenomena on continents. In this research topic A-1, the tectonics of the Earth crust leads to following geological characteristics:

1. Lifting of one plate above another at their contact, while lowering the other plate beneath the previous levels of plate's position.
2. Creation of greater porosity for water, air and Earth lava in the region of contacts of two plates and their undergoing.
3. Penetration of the Earth magma into the newly created porosity in the Earth crust and production of new minerals in the region of contacts of plates.
4. Influences of Spreading of continents leads also to large undersea mountains chairs and geographical, geomorphologic and geographical characteristics have also the effects on hydrological phenomena on continental surfaces. These phenomena are:
   a) Lifting of plates creates mountains, of orographic chains. Lowering of plates at the contact of two plates creates depressions in the Earth crust, such as the Dead Sea in the Middle East, depression in the West USA at the Death Valley, and depression in North Africa at the border of Egypt and Libya. Creation of that porosity means the larger transfer of water from oceans and seas to continental surfaces, and the opposite, the increase in the volume of water, which flows from those surfaces into the seas and oceans.
   b) The increase of porosity means that the influence of internal Earth’s temperature on the temperature of thermal waters, as well as affects their mineralization. The changes under water affected by tectonics will influence both the fresh and the thermal water.
   c) The penetration of molten magma will bring new minerals such as the copper ore, uranium ore; various metal ores and oil etc. It should not be forgotten that many mineral geologists give priority to these contacts areas in their search for minerals.

VI-C-2.2 Consequences of tectonics on hydrology. How one may explain why the highest mean annual precipitation of 6000 mm in Europe is only about 125 kilometers at the place Crkvice in Montenegro, from the minimum of precipitation of 400 mm in Central Europe at Macedonia, excerpt as the result of plate tectonics.

VI-C-2.3 General program of research. This research topic should consist of two general areas of study:

1. Review of the present status of geophysical knowledge on plate tectonics, which aspects of these studies have impacts on hydrological variables and processes on continental surfaces.
2. Find the effects of this tectonics on the contact region of plates, particularly the effects such as increase of porosity in the region increase in earthquakes, thermal waters (discharge changes, temperature, mineralization, etc.).

Section VI-C-3. Research topic A-2

VI-C-3.1 Investigation of relation between crust and hydrological phenomena and characteristics on earth crust. Investigation of the relationship between earthquakes and hydrological phenomena on the Earth surface. Results in the gliding of the big blocks of the Earth crust of the adjacent blocks. This creates earthquake which manifest them along and across the Earth crust. It lead to the different and various destructions in the underground and the surface of the Earth crust as well as creaking in the ocean and sea surface and underground waves create many seaside destruction along the oceans and seas for instance, tsunami of the year 2004. They created by the movement of large mountain blocks of rock a wave of about 10 meters has hit the coast of Thailand, Shri Lanka, India and other sea sides of the world. The tsunami had impact on other sea sides of the world. The tsunami has driven 120,000 people in those areas and has created enormous economic consequences. In the same time, the tsunami has changed a lot of hydrological characteristics of many costal areas of the central part of the Earth. When knowledge of the earthquake and tsunamis increased changes are of influences both of earthquake and tsunamis especially the prediction on at least in probability terms states.

VI-C-3.2 Research background. The belief of deep water wells in Colorado to dispose of radioactive liquids created an hypothesis based on some of observations that those wells are influencing earthquakes in such a way that the number of earthquakes after the well has put into operation has increased, but the average energy has very much decreased. In that way the hypothesis has been advanced that the larger number of earthquakes of lower intensity has the same energy as it would be before drilling of the well. Similarly such of the studies of the effect of large storage reservoirs on surface of the Earth are bricking other permeable rocks formation has also created the more often sliding of the earth blast rocks has created many more earthquakes but of the smaller intensity of energy than before. Also the same hypothesis is advanced that the earthquakes would be influenced to have larger number but smaller intensity.

VI-C-3.3 Research project. It would consist of experimental field by selecting several of the largest and the deepest wells in the world which had been drilled for other purposes not only for the effect on earthquakes. And due observations before the wells and reservoirs had been built as the basis material to be compare with and observe very carefully the effect of wells and reservoirs on the characteristics of the earthquakes. Basically it is good hypothesis to be proven by investigation that wells and reservoirs on previous rock formation would increase the number of the earthquakes that is more frequently occurring but of the smaller but usually not destructive energy.
Figure 1  Shows the map of four orographic mountain chains, which are the borders of the State of Macedonia: border with Albania at West, border with Greece at the South, at the border with Bulgaria at East, and border with Serbia at the North. They form a squiffre producing a central depression with now the State of Macedonia.
Figure 2  Shows the same map as Figure 1, except it gives for the four mountain chains with the average annual precipitation of peaks: about 1700 mm in the West, 1500 mm in the South, 1300 mm in the East and 1100 mm in the North. These values and their differences can be explained in function of distances of chains from the seas and the height orographic lifting which they impose on precipitation-producing, mountain chain-crossing air masses.
Section VI-C-4. Research topic A-3

VI-C-4.1 To decrease the effect of earthquakes on the hydrological phenomena. To decrease the effect of earthquakes on the hydrological characteristics of coastal areas in the air crust the research would be perform whether there are elements of dependence in the time series of earthquakes characteristics so as to be able to have any kind of deterministic prediction of the future occurrence if this does not show any significant dependence in time but pure stochastic distribution of characteristics of earthquakes and its characteristics than probability statement based on the large amount of data should be worked out and the effect of those probabilities on hydrological and water resources phenomena on the Earth's crust should be worked out.

Section VI-C-5. Research topic A-4

VI-C-5.1 Effects of Tsunamis on hydrological phenomena. Effects of tsunamis on hydrological phenomena expected in karsts areas. One should try to see whether the tsunamis could be at least foreseen as a potential event from the mountains of the bottom of the sea created by the spread of oceans of the continents. If one could determine shape of the mountains and the type of the blocks which create mountains on the bottom for example in the middle of Atlantic from the South to the North of the Earthrise or in the Pacific or in the other parts of the World than one should be able to at least speculate with high probability that speculation is correct how big and how often these tsunami wave created on the bottom of the seas and propagated to all to air crust through seas and oceans. And once the historic tsunamis had been analyzed as for their effect on the coastal hydrological and water recources problems then one could specifically designed better in focus research topic as to the realistic conclusions and measures to be taken in observing ocean phenomena and ocean bottom phenomena.

Section VI-C-6. Research topic A-5

VI-C-6.1 Three basic geophysical directions. Three basic geophysical directions on the Earth crust of importance in hydrology. They are water resources problem of solutions and knowledge on water if the contact of the Earth plates along which there is activity because of the movement of air plates. For instance figure three shows approximate directions of the contact of the Mediterranean and European Earth where on Mediterranean plate underground European plate.

1. The contact directions from the Alps along the Northern Italy, Northern Balkan, Northern Turkey to Iran. Along that line most of the large earthquakes had occurred in the last couple of thousand of years of the known history of major earthquake phenomena.

2. The second important direction of the chain of orographic mountains created by one crust plate undergoing another crust lifting that Earth crust above the sea level and creating mountain chains.
3. The third direction shown in the figure three is the average statistical direction of the air masses moving from the West to the East or differently according to the direction of the mountains. Because of the meteorite had been hitting the Earth in different directions and with different energy Earth crust had been gliding on its molten interior of the Earth and changed the North Pole as well as a direction of the air masses for instance according to some studies North Pole was in earlier where today is Sahara Desert and by hitting of the meteorite and internal Earth processes and moving of the molten magma the change of the directions of air masses has been continuous from time to time.

Those three directions determine today hydrological characteristics on the surface, underground and even in the atmosphere.

**VI-C-6.2 Research project.** The research should be done on how these three directions influence the basic characteristics of hydrological processes on the Earth surface. These characteristics should have an influence in mathematical modeling of hydrological processes as well as relationships between hydrological processes and three characteristic directions.

1. The first direction is contact of the Earth plates and is described in the previous text for the research how that direction influences the hydrological processes.

2. The second direction is presented in figure two which is the central part of Dinari Mountains in the Central Yugoslavia. Figure three can be taken as the major influence how could one conceive the second direction on the influence of hydrological process. It is shown that direction goes from south to east and from the north to west as it is showed in the figure. This is explanation for the picture F-3. Dinaric Mountain shows as a barrier to the movement of the air masses from the west to the east as classical movement of air masses because of the rotation of the air around each axis from the west to the east. The legend shows the average direction as well as approximately computed normal direction of the average mountain direction of crossing the mountain by the air masses. These characteristics of water resources precipitation, evaporation in river flows in before of after orographic mountains of Dinari chain. Figure two shows in the systematic way (figure four – the blue lines show the enlargement of topography over the first direction of orographic Dinari Mountain. The blue collected enlarged areas showed that air masses usually go over Dinari Mountain in direction number three while direction one in the top of the figure shows the contact of the Mediterranean Earth plate undergoing European Earth plate.)
CHAPTER VI-D

B - GROUP OF RESEARCH TOPICS

Section VI-D-1. Related to the potential mathematical models for description of the characteristics of hydrological processes over the continental areas

VI-D-1.1 Mathematical description of models of hydrological processes as function of latitude, longitude and altitude over continental area. As hydrology is usually defined only on the continental surfaces description of distribution of hydrological processes and their characteristics over the Earth surface must be very carefully investigated. Of these processes usually include precipitation which means distribution of precipitation in over the continental surfaces as well as in time. The second process is evaporation which also has distribution over the continental surfaces including the water surfaces on the continents themselves.

VI-D-1.2 Description of one, two and three special as well as time dimension. The third Hydrological processes which are of interest on the continental surfaces are river flows and sediment transport in river with sediment depositions. Therefore these processes have been observed by selecting the points on the surface at which precipitation as well as evaporation has been measured as it concerned rivers the measurement have been at points of the cross sections of rivers for both sediment and water flows. In conclusion it can be stated that hydrological processes can be conceived as four dimensional processes in such a way that three space dimensions for any point of the continental surfaces on the land are described by three dimensions and also as they are changing in time, the fourth dimension will be time itself. So any variable describing individual processes such as for instance daily precipitation or daily evaporation or anion precipitation or anion evaporation river flows per se or so on could be described for any point cross section in four dimensions so any variable u = f (x,y,z,t / x0,y0,z0,t) what means point at each observations wait period.

VI-D-1.3 Practical approach for developing simple mathematical description models. It would be very convenient for the general hydrological research if there would be possibility to use the existing data on point or cross section measurements to develop mathematical description of how different variable describing those processes could be generalized. In another words the four dimensional processes could give possibility to be seen condense information on very simple mathematical models as function of four variables, which are four dimensions and using mathematical equations with their parameters being estimated from available data. There will be several research projects which would be possible to describe these processes mathematically.

VI-D-1.4 Use of three major characteristics of earth (latitude, longitude and altitude) and practical descriptions of change hydrological processes. As the Earth surface is usually described by latitudes and longitudes the first approach would be to use
the circles of latitudes from one pole to next pole with approximately circles being the smallest close to the poles and the largest at the Equator. Similarly the other surface dimension should go along meridians from one pole to the Equator and to the other pole. In such a way that also will be close to the circles and so on, in these situations x and y would be defined by the selected by the close circular close to the circle changes x to y. The third dimension z will be vertical normal to the Earth surface then measuring elevation of the karst in comparison with sea level or any other definition of the surface on the Earth. In that situation the z dimension would be negative point below zero surface of the Earth and positive for orographic lifting. However as the continent are one smaller part of total Earth in these surface descriptions will be valid only for continental part of certain values of x and y dimensions. And the time is very important factor in fluctuation of the hydrological processes that will be measured an abnormal time with its characteristics of the periodicity and stochastic as the major characteristics of the time fluctuations of hydrological variables.

Section VI-D-2. Research topic B-1

VI-D-2.1 General four dimensional programs. In this research topic, Yevjevich is searching for the best mathematical description in four dimensions. The general model would be like this:

- If we would like to present year rainfall by one simple equation where P-precipitation: \( P = F(x, y, z, t) \)

In this equation variable P which is anion precipitation is a function of dimensions x y z and the function of time what means sequence of years and parameters \( \alpha, \beta, \gamma, \tau \), which can be not only one of each of these but many parameters under the same symbol \( \alpha, \beta, \gamma, \tau \). It is presented that borders of surface for which model is making are latitudes and longitudes on the Earth surface. D-2 area is in the grand plane in western United States between Pittsburgh and Rocky Mountain chains. The reason that this area should be taken as an experimental polygon to test potential for developing four dimensional models is that the area has large number of precipitation station in a data going in very large number that the model could be developed and tested. Because this station would permit determination how the anion precipitation changes in x, y directions as well as influence of the z values, also it can be by using coloration coefficient between anion precipitation it would be possible to determine how major direction of Earth masses influence the dependence in time and area.

Section VI-D-3. Research topic B-2

VI-D-3.1 Four dimensional mathematical model of anion precipitation of the great plates in the United States. Similarly as the four dimensional models is one could use three dimensional models. In that situation or could use F for precipitation can use model of \( P, X, Y, T \) which would be equivalent to describing how the anion precipitation changes over the area any time for a given surface area. Similarly four dimension model
could be $P = F, X, Z, T$ as the change of anion precipitation latitude and orographic lifting of air masses as well as time or it can be written as $XYZT$ as the change of the anion precipitation on the longitude as well as orographic lifting at time. Similarly to the three dimensional models one can use two dimensional models taking $XT, YT, ZT$ etc. All of these given points or area or line is on continental surfaces. Definitive one dimensional model can be also developing such as for instance $P = F$ or $S$. Some variables only change over the latitude. $P = f(y)$ as variable changes with longitude as well as $P = f(z)$ how variables changes with the altitude of the orographically elevated terrene as well as classical function $P = f(t)$ how precipitation at the given station changes with time.

Section VI-D-4. Research topic B-3

VI-D-4.1 Three dimensional mathematical models. In fact of the observation length and position for every variable on the mathematical modeling of characteristic on hydrological processes and variables. Types of data on precipitation, evaporation, river flows, sediment transport by rivers and etc. are conceive in such a way. For instance on many stations only daily rainfall is measured on some other are only accumulated measure for a longer period of time. Similarly the lowest intensities of those variables are only rarely measured for instance in air by areas as 10 min, 15 min, 20min, an half an hour rainfall is recorded on substation as intensity influencing design of air by drainage and plat control. Those characteristics of observe data should be studied as influence mathematical model of four, three, two and one dimensional mathematical descriptions of hydrological characteristics.

Section VI-D-5. Research topic B-4

VI-D-5.1 New experimental key project for obtaining more accurate data for small time and small distance characteristics of hydrological variables. This project would be selecting an area say hundred by hundred meters, or eighty by hundred meters with many gauging stations, movable from one to the other terrene for observing for couple of years what is the relationship between smaller time units or smaller space distances of daily stations. So that characteristics of those smaller time and space distances between stations or measurements could be available at mathematical models could be extra to extremes of low and high values if necessary.

Section VI-D-6. Research topic B-5

VI-D-6.1 Ratios among the parameters of hydrological time series in function of time. How variants, for instance mean and standard deviation in the form of coefficient of variation are related in time and time series goes from minutes to hours, to days, to weeks, months, to years and so one. Similarly how are summate coefficient and coefficient of variation related in time? Also, how kurtosis summits and coefficient of
variation are related. How the Otto regression coefficient are related to other dimensions parameters. Are there some other parameters which can have for instance different between maximum and minimum flow in given time interval and function of time interval. How there can be used in anything in water resource area in other words relations between parameters in time in different types of new concept of parameters which can have influence on water resources decision making process.

Section VI-D-7. Research topic B-6

VI-D-7.1 Relations on hydrological parameters in space. Special along the river in one dimension across the area in three dimensions or across the space in Lakes Reservoir ground water aqueducts and etc. These ratios in functional combination three dimensions may be of interest for transfer of information in space to how the first otto correlation coefficient researches row 1 is related to x, y dimensions may be of interest to transfer of information. This relationship between the parameters and different distances in three dimension and time on all four dimensions may be of interest in making the bridge between hydrological information extraction and decision in water resources area.

Section VI-D-8. Research topic B-7

VI-D-8.1 Transfer of information in hydrology. Hydrology is relatively observing small number of time series in space as well as limits the length in time. Therefore the position of the places which measurements are made like precipitation station evaporation stations, cross section of river flows, lake levels etc. are limited in number. Also, the position where information is needed is usually very rarely the same time and same place when the information is needed. So, from the points where information is needed and from the time information is available to places where information is needed as well for the time units for the time interval the information available is different then for the time period which is the best way to have information. Therefore the methodologies of the transfer of information to the statistically and probabilistically analyzed and methods for measuring how much information is transfer from the place of available information of places on measurement to places where is very necessary. Transfer of information is very important aspect of hydrological influence how much is known about water resources variability or demand in regent.
CHAPTER VI-E

C – GROUP OF RESEARCH TOPICS

Section VI-E-1. Research topics C-1

VI-E-1.1 Method of observation of water quality where multiple characteristics to be observed. That methodology should be design as the new research results are coming available so that variables could be selected which could be measured on the best way or recording to the needs on that station as well as instrument for simultaneous observation of many variables, among them are integrated variables in time or in space and this should be very well explain and design under what conditions should be used.

Section VI-E-2. Research topics C-2

VI-E-2.1 Impact of pollutants on rivers, lakes and ground waters. One should continue to study how should new technology, new materials, new agriculture manning and pimbel, cutting and processing influence of the pollution of water. How point pollution propagate how area captivation and use in pacting. This would enable to control pollution much efficiently then it’s in present.

Section VI-E-3. Research topics C-3

VI-E-3.1 Global measures on tenability of rock formation. Why in details porosity of the water in underground may go from the drain size of different size small fishcher all up to large channels and fold separation so that periodicity may change the either on some partners or piratical. Is it possible to analyze how combination of different characteristic porosity measure by some hydraulic constants for different character of periodicity and than combine them in to the general situation so that in studding reservoirs along the rivers which water penetrates into sediment of the river itself as well as underline rocks can be measure by some general methods of approximate measures.

Section VI-E-4. Research topics C-4

VI-E-4.1 This group covers hydrological research topics which are related to dolomites, calcify carbonate rocks. Hydrology of karstyfied carbonates rocks. Calcified stone and dolomite calcified carbonate rocks have usually very complex hydrological phenomena which are necessary to investigated if calcify water has to be utilized as well as controlled on most economical and safe way. Here will be presented research topic in order of the complexity as well as difficulty to find solutions for those research problems. Especially of importance is the fact that in most ocean and sea costal areas carbon deposited under sea have been calcified in such a way that many rainfall
infiltrated waters come as the springs close to the sea. Those springs very often have water which is picture of sea water and fresh water mix sometimes underground.

Section VI-E-5. Research topics C-5

VI-E-5.1 Influence of the last ice age approximately 2 million years on the complexity of the calcified large carbonate rocks close to the sea level or oscillation of the ocean during the ice age. According to the Milutin Milankovic studies during the First World War on the influence of the planets especially of the Jupiter and they related around the Sun on the phenomena climatic and ocean phenomena on the Earth. Seamed in the history of Earth there have been three times so called Ice Ages. In that situation the climate was changing in such a way that winter had a lot of precipitation which accumulated ice and snow on the mountains and polar caps. During the summer the colder climate did not melt the winter accumulated snow and ice and that start to accumulate snow and ice year by year of the average over hundreds of thousands of years. For instance during the last ice age which was during 2 millions of years one time at ice and snow depth at Chicago was about 3,000 meters so ice progressed from north and south poles and from mountains down covering large portions of land the moisture from ice and snow came from the oceans so the level of the ocean first oscillate and decreased the minimum of 105 mm lower than today. When influence changes that winter has less soil precipitation and summer has wanner climate melting the snow and ice accumulating the level of the oceans started to increase, so the circle in the ice age on the average ocean moved from the present level down about hundred and twenty five meters and came back to about the same level today. There is not yet showing whether the ice age has been completed in the sense of melting of the snow and ice. The geophysics investigator consider that the melting of the glaciers and snow on the polar caps has been caused by the released of the heat accumulated biological gas, oil and cols it seamed that also that recovery in the changes in the climate by the orbit of the climate is not yet finished there fore calcification has had one composition of the karst on the underground karst channels and the water flow specially as karst plains, karst springs, karst ponors, as well as other karst phenomena prior to the ice age. The ............. of those calcifications was approximately the present level of the oceans and seas, prior to the beginning of the ice age. During the ice age of 2 million year calcification was differently developing due to the lower level of the ocean sea as the base of calcification. Question is that the second time of the calcification of 2 million years has created new phenomena in the costal area thus overlapping with calcification characteristics of the pre ice age time. It was complicated situation, to prove this one can karst spring underwater which is about hundred twenty to hundred fifty meters below the present level of the water in the ocean. For instance in Natalie Bay in Mediterranean part of the Turkey there is karst spring about hundred meters where sea lions raise their young because of the less saline water than it is the case with normal sea water. So decalcification proves there is deepen but connected with pre ice age calcification. As many attempts to separate saline from fresh water underground failed. One of the reasons is complexity of the connection of the pre ice age and during ice age calcification types. This is only one hypothesis which has been practically investigated. This project should try to find as much as
possible interaction between these two different bases of calcification during last 2 to 3 millions of years. The objective would be to understand interplay between two calcification types or between pre ice age calcification and changing the base level during the ice age calcification.

Section VI-E-6. Research topics C-6

VI-E-6.1 Study of genesis of karst polje. Study of genesis of karst polje in the pare thesis carbonate rocks created as well as sediment and carbonate rocks dissolution and deposit on deformation of karst plane usually in costal areas or an orographic lifting of carbonated rocks and mixed with other rocks. The .............. without outlet or rivers in orographic lifting very often has been filed with water which has been penetrating the carbonate rocks and slowly dissolving the carbonate creating calcified sinks, cannels, springs thus creating evacuation of surface water from the filled in close valleys. However, the rivers coming in to valleys brought sediments as well as carbonate rocks which have enough dissolved carbonate material than they have been under influence of the CO₂ with dissolved carbonate rocks and release of CO₂ and depositor carbonate rocks into the time deposits. So the structure of the filling in of the lakes of the closed valley in the carbonate rocks has been filled either, by the sediment of different materials or deposited or other materials carried by the water. This is important for understanding hydrology of the underground of surface of karst close planes and also water filtering through the sediment and going to the underground cannels and springs which are located hundreds of meters below the surface of the poljes. Those outlets in downstream springs very often have dissolved carbonate rocks and creating springs in the lowest points of the carbonate formations. Very often it is very easy to create in the carbonate rocks underground dam on the injected materials and create hydropower which have been used the outflow from the material of the filled in valley so to create dam side understand the structure and influence of the composition of the filled in valleys, which have been created by karst poljes. It would be very useful to study structure of the underground of the karst poljes or understanding the underground flow water with high precipitation of the karst mountains and the sea. Two special experimental polygons can be the karst poljes of Glamoc Polje the other Poljes in the Bosnia and Herzegovina and water coming out at Pliva River spring and Sana River as a tributary of Una River in The Bosnia and Croatia. The karst poljes of Dinaric Mountains give excellent possibility of studying the underground material of karst polje and flow of water from surface to underground or from underground to surface in the steps over from the Dinaric Mountain lifting.

Section VI-E-7. Research topics C-7

VI-E-7.1 Water minimum and maximum. Karst springs around the world have different characteristics of outlets as well as the quantity of water in minimum and maximum. The spring varies in many openings either on the same level or scattered over some differences in the height as well as vary from the very minimum to the one or several outlet as well as maximum flow during maximum precipitation. How these
differences in the number of karst springs as well as differences are created tectonically and sedimentation of the material in karst rivers and karst poljes is of economical interest. It seemed to me that the highest minimum flow from any karst springs in the world is in the Panagua River basin is the Spring In Oima Pinar reservoir ....... Southern ............... that spring is called ................. It seemed to me that in the minimum it had 23 m$^3$/s. It seemed to me had that spring as well as its background of river basis supplying that water is of interest to explain this phenomena of the differences in the number and elevation of holes giving during the year different discharges of water and different places. Therefore this research project can be conceived as a Taurus Mountain area in the Southern Turkey. It seemed to me that tectonic creating that mountain had been done in sequence braking ones folded material so that upper level as figure six shows get a limestone formation which has been karsified with time and created spring in contact with impervious layers of folding. Than rivers and creaks filled in created valley, and created horizontal small stream between spring and a contact with low level deformation than going over this plane of stream and again six into the next karstic formation of the previous folding. So in the several of those sequences every time the next lower formations have higher average flows larger six and larger underground canals and larger springs than next formation in this way has been able to form the lowest point outlet of min 23 m$^3$/s as the major low flow contributors to Managua River. Also during the highest precipitation and underground flow the higher level and upstream springs got waters as a spillways and increase flows of Managva River these largest and heights folding elements probably in the world may be very nice research polygon in the Anatolia region of Mediterranean coast of the Turkey. For that purpose quite likely any research project should be done either with the Turkey water resources agency.
Figure 6. Legend: A scheme showing how large spring has been created with the highest one hole karst spring discharge probably in the entire world eventually not taking undersea karst spring in some areas which are not accessible for measurement for minimum fresh water outflow.

This research can be done regardless the Oima Pinar Reservoir arch dam and big reservoir has flooded the Unmanly spring of about 17 or more metes because there are some measurements of spring which have been captured of water supply destroyed aqueduct which was done from the left of the Managvac River to the right side of the Managvac River.
Section VI-E-8. Research topics C-8

VI-E-8.1 The estimate of the underground reservoir storage volume of the underground karasified formation. There is a large underground storage in the limestone of the karasified formation in Antalia area when there is so called spill way of the underground storage. In fact all of the forty so called springs are one outlet from the spillway of the underground water storage which might have close to 50 billion m$^3$ of the space filled with underground water. All of this springs Arapahsmetly are on the same level and have been created by exposing water to the air to release of the CO$_2$ and with that deposit of travel time carbonate layers formations and create a travertine small in ground areas over which the forty springs water is flowing in small streams seeking underground into the channels in travertine and coming secondary as tertiary springs all over costal area of Antalia travertine and than water goes into the sea with caring some of the carbonate dissolver material in the sea. The fluctuations of 41 (kelgezel) springs are practically showing that this is spillover from large calcified formation. In order to be able eventually to use this formation by pumping water by wells in to reservoir but drying out springs but concentrating its water into the pump out quantity of water which would be distributed properly for water supply irrigation and other purposes in Antalia region. It would be necessary how much water is in the formation and how much fluctuates in time input and output. This can be done by some ......ings into the reservoir formation looking at the characteristics of the outflows and measuring contents of dissolved carbonate in the spring water and underground water as well as how much is totally accumulated which have been determined, as well as measuring the influence of the inflow of the water into the sea, from the primary spring through water flow over the surface, as well as through secondary and tertiary springs how much carbonate rocks in water carries into the sea. With computing carbonate rocks into the spring carbonate content, volume of the travertine, as well as carbonate taken to the sea it would be feasible, eventually, to determine approximate underground storage in dividing in practical way how much carbonate is been dissolved by the subsurface flow, above the reservoir, as well as, how much is been dissolved from the rocks into the reservoir. This would be very approximate estimation but might be discovering some relationships which can be used on estimating how much underground storage in calcified formations may have been form, historically due to the solution of the carbonate rocks inside the underground reservoir.

Section VI-E-9. Research topics C-9

VI-E-9.1 General karst phenomena research. To better understand the karst phenomena, especially highly calcified rock formations the specific research has been done on the several characteristically karst phenomena on the formation of sinks due to tectonic permitting water flow to the outlet of the fissures downstream as small karst springs. Furthermore how the structure of the limestone and dolomites which are calcified as well as other formations tectonically have been predispose for underground inflows and springs, also it would be very useful to study several karst phenomena which would be of high influence of the special hydrology karst phenomena as well as
underground karst phenomena. This will be general research on calcification of carbonate and other rocks. Similarly as studies done for lava that formations by volcanoes or under sea or on surface, as well as creation of porosity in sense stones with several types of high porosity as falls, high falls, filchers and background porosity of the formation of sense stones. All these would contribute to the general understanding how underground porosity works for relationships between surface, underground and river flows in hydrological processes.

Section VI-E-10. Research topics C-10

VI-E-10.1 Study how to capture underground karst waters of large poles. The example on the Trebisnjica River basin is very interesting case which would be studied as well as prove how water could be capture regardless that is very deep flowing in area with deep flows. In the center of the Trebisnjica River between Tetovo and Popovo Polje south and there are so called spillway springs, low flows of those springs go under canals and underground Trebisnjica River channel and go into the deep karsified area between Trebisnjica and Adriatic sea near Dubrovnic and those underground water courses from Ljubinje area which come as a spring from the Ombla River of the level of the sea near Dubrovnik, have been of interest how to be studied, developed and used. There have been two ideas to implement that outlet at Ombla River spring in the approximate level of the Adriatic sea comes water from the big hole in limestone material it would be easy to create impervious dam by injection into the porosity of that rock and close any large canals with outlet controlling the raising of the level underground on lime stones channels and porosity. Than one could implant an underground or close to the spring hydroelectric power plan. The other idea would be to capture underground low flow and high flow equally effective and that water would be brought to the level of the Trebisnjica River and either put into the Trebisnjica River for use in hydroelectric power plan capljina or use for a supply of large horizontal plato of karsified large lime stone after the plato has been so arranged that it would be one of the best places in Yugoslavia for creating an industrial part. This industrial part would be supplied by the water those captured underground spring's waters and diverted into the industrialparkas well as south west of that to create a large horizontal area of fish raising, especially for trout for commercial market because of the cold and clear water coming out of the mountain. The two sites of the flow north of Trebisnjica River have been shifted one versus the other and tilted in such a way that on the surface the ......... is open a little and filled with ............. material of the soil of the surface and in the inside the mountain the two sides have been pressed one another to create small channels through which only small discharges could pass. The fine structure of the limestone by pressures have been different along the course so the differences between the structure be underground and the surface could leave small exploration tunnel which would go from area of spillway springs near Trebisnjica into the finding the underground course of the small discharge of ............. m$^3$/s which come from the area of the Ljubinje Mountain underground river basin. Once the exploration tunnel has reached then spring would be either captured and pumped out to the exploration tunnel or building gravity new tunnel depending on the length of both tunnels would be derived into the area above the right bank of the
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Prof. Dr. Vujica Yevjevich

Trebisnjica River channel. Than that water from canal and pump would be diverted into the river Trebisnjica and used either for industrial park of rising of the fish would be decided by Trebinje city and county than water would be given to water supply of the industrial park as well as rising of the fish. Even if the future Croatian settlements along the islands in Dalmatia especially in the area near the Peljesac peninsula would be dedicated raise food as well as fish in Adriatic sea which would require mixing of the fresh and saline water for best salinity for raising the sea food in that area. In that way if it comes out by the tunnel of smaller dimensions should be built between Trebisnjica industrial plato and slano area of Adriatic sea with a small hydro electric power plan between Trebisnjica River and Adriatic sea as well as supplying water for tourist purposes in that area which would be an example of investigating and finding the underground courses in karst areas as well as how to use it in development and water resources hydro power from karst areas.

Section VI-E-11. Research topics C-11

VI-E-11.1 Generalization of experience building the reservoirs in karst areas. There have been several hundred reservoirs built in the world in karst areas. Problem of imperviousness of reservoir of loosing water in different direction and different way have been made. One can describe the reservoirs existing or being attempted in the world to generalize the reason why imperviousness have been concord by successful methods or attempt to fight the loss of water have been completely failed and building of the reservoir is abandoned. In that situation one can classify four categories of these reservoirs: Full successes, partial successes, probably losses and complete failure to get good results. Each of the categories will be shown in number of reservoirs and get statistical characteristics of building reservoirs in karst areas. In that situation that formation would help the future designer and planer designer and constructor of reservoirs in karstified areas. Yevjevich has a lot of experience in these reservoirs not only in Yugoslavia but also in the Middle East and other parts of the world in Europe.

Section VI-E-12. Research topics C-12

VI-E-12.1 Surface underground portions of the useful range of the levels of the surface reservoir. In many reservoirs there is a very little underground storage which fluctuate the fluctuation of the surface part of the water of the reservoir. However in some cases especially in the limestone can have significant volume of underground water storage? When the reservoir is being filled by the river the response of the level is relatively very fast because of the fast travel of the change of the level of the upper part of the spillway part of the dam. However if water has to infiltrate to much resistance into the underground there would be delay in the level of the ground water which would increase the level of the sinking of the surface storage part of the reservoir in cases of the bank formations of lava created pores underground or on sencestone porosity which has different type of porosity like primary original sencestone fine porosity small fischer in the rocks small folds large folds and so on, can create significant portion of the reservoir.
An excellent example in the lake Pavel in Colorado River which has large pelivar surface storage volume between the highest and minimum level of operation but at the same time there is a tremendous porosity on the sencestone which help water passage in both directions between surface and underground storage areas by first going to the large folds, secondary folds and tertiary folds and finally to porosity of fischers and drain porosity of the sencestone. It seems tome that the estimate of the underground storage by the below reclamation of six million acre feet has been much more conservative and the storage of underground the lake between the highest and the lowest reservoir in operation might be as much as two three times those estimated and delay time because of the resistance of the porosity to infiltration into much smaller and others less porous rocks at the banks of the reservoir. This problem of estimating of the ground water porosity storage of the large reservoirs is and percentage of the total storage surface and underground has many more aspects of applications. One can stand the idea that is not important how much storage there and shown in the operations but for planning purposes these estimates would be very nice before decision is made to build and how to operate a reservoir. There are many and many examples in the world of reservoirs which are sure pilot reservoirs which have these results of estimation.

CHAPTER VI-F

D – GROUP OF RESEARCH TOPICS

Section VI-F-1. Hydrology of reservoirs

VI-F-1.1........... Entire research of rivers and lakes have been connected for creating reservoirs for capturing water during high flow periods to be used when flows are very low but needs are very high. Maybe there is about ten thousand years in which humanity has developed technology of building reservoirs and using them for water resources development. Now there are so many reservoirs in the world for instance in Adriatic there are about 5000 medium size reservoirs and about 50,000 small reservoirs all around the country. And the number is continuously increasing for different reasons. Several topics related to reservoirs are of interest for hydrological research.

Section VI-F-2. Research topic D-1

VI-F-2.1 Estimates for water transfer from ocean and the continents by the reservoirs. In the period the question of the raising of the oceans due to melting of the ice caps and mountain glaciers it is problem how to determine the effect of building the reservoirs on balance of water between oceans and continents. There is now close to one billion hectares of partial fully irrigated land in the world. All those reservoirs are filled
by the rivers and in fact by the precipitation on the continental areas. The complex relationship between oceans and continental water balances may be improved by studying how much water is being retained by building reservoirs. If one of reservoirs for instance for irrigation of hydropower then the volume of the water filling the back space of the reservoir of space enrolled minimum of reservoir levels as well as how rich period of the time of the year how much water is retained in reservoirs all around the world. International commission for large dams has been attempting to compute how much water has been obtained or kept in the reservoirs during the year. Seasonal variation is often most important factor. Water from precipitation in rivers which fills the reservoirs has been used in such a way first for evaporation from reservoirs that also may increase the precipitation which forms over the river basin giving the part of the evaporated water back to the reservoir by increasing the precipitation. Than the water goes to the canals and channels to the users which was o be filled to be given back in order to the transfer of water between the reservoirs and the user area. Third the .......tion and irrigation area which means ground water is increased and entire volume is also increased during the irrigation period. Similarly the other uses of water have to go to the water supply system and that space must be filled before water comes to lake. All this may be estimated and found how much new spaces are covered by building reservoirs. It would be very interesting to study the type of reservoirs and percent of the value of the water in transfer from seas to continent. This study must be organized by international level that from each country, each continent some group under development method evaluate how much water have been transferred and used by the reservoirs and so one, how much water have been transferred from oceans to continent by reservoirs. This would be important not only to study the effect of building reservoirs all over the world and problems with this transfer of water that might be influencing the costal area of the continental surface of the Earth. This study is relatively difficult to have precisely in determining but it can be done in some approximate way because the reservoirs must have the bunch of decrease of the level of all ocean of 3-10 cm in the last couple of thousands of years. Then by making 30%, of error would not be significant in analysis of this topic.

Section VI-F-3. Research topic D-2

VI-F-3.1 The position of sediment in the reservoirs in most cases the world and being either slow or fast filled ...... in the sediment which have been sediment on the bottom of the all channels or in the new space of the reservoir. Usually upstream are courser material the porosity as velocity is decreased and because of the volume of the water in the reservoirs only the fine particles create density current which go along the bottom and come to the land and can be evacuated by proper method. As the level fluctuates during the operation of the reservoir so the deposition of the course material basically stand in gravel in upstream part of reservoir with sharp drop of the bottom of the reservoir when material stand level of each one has been completed. In many cases the colloidal material in water has been flowing on the lowest channel of the river on which reservoir has been built and on some come to the dam site is the proper opening is available for those current, or from time to time, mark the lake created the lowest part of reservoir can be evacuated and so on space of reservoir for courser material to be filled in
which can not be evacuated by density current. These relation between sediment size and specific plate of drains is question which we studied for both reservoirs as well as sediment retention transportation and entry phenomena by the using the experience with many large such a reservoirs.

Section VI-F-4. Research topic D-3

VI-F-4.1 Reservoirs have put production area of the world. Reservoirs are flooding very often land ...... of different types. By flooding reserve those ........... usually stopped. However reservoirs can be very food producing areas rising fish and other water related animals and plants. There would have tremendous difference in hydrological processes ................ developed fully as agricultural or sea food or water producing areas. How this should influence the hydrology of reservoirs ............. of proper analysis.

CHAPTER VI-G

E - GROUP OF RESEARCH TOPICS

Section VI-G-1. Research topics E-1

VI-G-1.1 Related to floods and droughts. Flood and droughts for high and low flows of water are the most important hydrological topics for research because of the tremendous influence of the water supply and solution of related problems. The floods are concerned how to estimate the characteristics probability of current as well as controlling the flood and impacts similarly droughts are important in production of food as well as raising of animals, either human controlled ................... Irrigation droughts are phenomena which have tremendous impact of the Earth surface in developing of human communities, migrations, wars and other aspects of drought phenomena therefore hydrological studies of the drought and flood related topics is enormous economical terms. One could tell that flood and drought are apart from the average ability and fluctuations of available water are the most important subjects in the use of hydrological information to solve water resources development problems.

Section VI-G-2. Research topics E-2

VI-G-2.1 Distribution of flood. Usually in designing structures related to flood controlled one has to determine what are the probability of particular characteristic of flood, hundred years flood or thousand years flood which means flood which on the
average ones in hundred or thousand years has exceeded or non exceeded. These probability solution are the basic information for the risk analysis any solution of flood controlled problems. Usually it a tail of flood distribution which is important in study is a question whether the any reason exist for flood from tail of the flood to be by particular solution function there is some of the phenomena of limiting phenomena. One can ask whether the tail distribution of large rivers or any other flood related variable can be described by two parameters. Lets say beginning flood is discharge of level as one parameter and simple exponential function the other one parameter the question also is ask how the probability can be treated and measures how fit is or how reliable is information by mathematical modeling distribution.

Section VI-G-3. Research topics E-3

VI-G-3.1 Role of floods and probability distributions of survival of dam and reservoir and historical terms. It is worth study how deterministic aspect one consider there is maximum flood discharge which can be created river profile misconception determinist of hydrology. One can not prove that there is either a maximum density of the rainfall because it depends of the sickness of the air water and compensating water by lifting the air masses. One can also ask if the maximum precipitation has been determine by sickness of the air masses caring percentage of water of air and lifting amount of height three factors determine for any place for maximum precipitation whether these three factors small factors higher assume distribution. So one can prove that there is no limit probability elements of processes creating the flood. There is flood concept of flood assuming and Earth and atmosphere and climate are constant for thousands of millions of hundreds of millions of years. One can consider one million floods or one billion year flood assuming that the present of physical conditions are the same creating the flood. This philosophical approach to deterministic flood characteristic or stochastic of probability govern characteristics are more adequate for solution of problems.

Section VI-G-4. Research topics E-4

VI-G-4.1 In fact of different flood differentiation methods of solution on the characteristics downstream of the river. The of structure three surface of dam of the dam or to the closed type evacuation influence on the safety from the floods these should be very well clearly designed and found how the influence effects of flood on surrounding upstream and downstream condition. Similarly the effect on reservoirs and lakes floods characteristics as well as river channel technology of excluding flood planes or including flood are very important. Also it is worth to study how one can find flood damages by specially preparing the section of the river which could be evacuated and that flood entire area as example in the Youngster River downstream of the area near volcano where the valley of the Youngster River is prepared in a such a way that population, animals and important instrument and equipment can be evacuated.
in specially prepared barracks and other storage spaces that diversion of the Youngster river in floods from the channel into those areas was about fifteen thousands cubic meters per second out to the total flood of 55,000 m$^3$/s and diversion structure was so prepared that Chinese army constructed diversion and installed controlled gates in about 80 days so the flood controls structure and minimizing the damage of floods necessary for the living with the flood in the most efficient way.

Section VI-G-5. Research topics E-5

VI-G-5.1 Computing probabilities of large area time droughts. Droughts are phenomena which have very large length of continuous below average values of available water as well as higher value of precipitation can create large deficit areas and volumes during the drought. The example of the large drought in western United States is in Great Planes between Avalanche and Rocky Mountains are excellent example of how one could study historical large droughts of several continents like Central Australia, Sahara and Sub Sahara region, Mongolian region Gobi desert, etc.

Section VI-G-6. Research topics E-6

VI-G-6.1 Modeling space time distribution of droughts. In conceiving droughts as a concept dependent on time and space dimensions one can mathematically model probabilities of variables of drought phenomena as mathematical four dimension model.

CHAPTER VI-H

F - GROUP OF RESEARCH TOPICS

Section VI-H-1. Research topics F-1

VI-H-1.1 Sediment is part of hydrological process. Water erodes the surface as well as rocks and wind does the same. They create some kind of interaction between water and sediment at the surface of continents as well as rivers, lakes and reservoirs. Relationship between sediment and water and balance of both has several topics of interest for water resources development.
Section VI-H-2. Research topics F-2

VI-H-2.1 Supply sources and supply of sediment. Erosion process starts as soon as the orografic lifting or depression are created on the Earth surface and rainfall is coming with each impact as well as caring capacity starts to erode ororaphycaly lifted or subsided areas. Then wind and water are caring sediment and deposit where wind is subsided and water has smaller velocity than necessary to carry the sediment. Research project should be describing how different types of soils slopes winds and water are being eroded and supplied to the river and along as well as deposited in a proper way. Dimension of topics and reservoirs and sediment depositions this is question of the influence of the sediments on all aspects of surface and underground hydrology.

Section VI-H-3. Research topics F-3

VI-H-3.1 Study of time filling the reservoirs by the sediment when no measure can be done in river basin or in reservoir to impede coming sediment in to the reservoir or evacuate sediment by proper methods. That determines the................of the reservoir and the influence of the reservoir on hydrological downstream processes and evaporation and eventually quality of water released by the reservoir. The history of filling the reservoir is very well demonstrated by the tectonic creating valleys which is the first...............water and than filled in by the water ............ sediments by carst poljes in carst areas of the different parts of the world. The method of determining supply of sediments by either measurements or experimental small ponds of water created by experimental dams and other methods of measuring total capacity of caring sediments of different sizes these could be tremendous information important for planning for water resources project and quality of water delivered by those projects.

Section VI-H-4. Research topics F-4

VI-H-4.1 The relationship between water and sediment especially those deposited by the river itself determines how one could consolidated the banks and the river channels of rivers as well as how would they be influenced hydrological processes along the rivers. So sediment movement in the river channels and creation of the small river channels in the center of cross section of rivers for evacuation of sediment of different sizes are important for hydraulic and hydrological topics for study. For instance stability of banks and channels in Danube area of Europe is very interesting for instance the Danube River in Panonian plane is moving in its own sediment and the banks are composed on deposite sediments gravel so it was easy to undercut the banks and having material the bank sliding into the river. So Danube is more inclined to be a wide shallow river for each size however the banks material on the Tisa River at the same area have been excavated and to create a channel which is mostly in the compacted fine material and fine sand material as compacted banks and channel material so that river has deep narrow channel that is opposite of Danube river channel. This phenomenon of river creating its own channel of specific characteristic in function of deposited material is of
interest for hydrological phenomena and river flows and river phenomena of importance for sediment control policy.

CHAPTER VI-I

G - GROUP OF RESEARCH TOPICS

Section VI-I-1. Research topics G-1

VI-I-1.1 Studying groundwater hydrologic phenomena. Ground water can usually be considered as inputs and outputs and storage of the water as well as the way how they can be filling or emptying and creating different water quality characteristic by infiltrating water into the ground and getting influence on proper places.

Section VI-I-2. Research topics G-2

VI-I-2.1 Studying ground water hydrologic phenomena
It was shown that very often ground water are emptied they have the raising the underground level by the either sheet flow along the lines, or area by outlet or by springs. In general measuring of ground level water can show two things. How they could be filling with water, as well as how they have been emptying, once filling have been stopped. And they effect have occurred. Modeling can usually be done by combining physical and statistical data for instance if one find that emptying of ground water during the no rainfall input into the ground water can be simple exponential function discharge decreasing in time by simple exponential function. If that is the case, one can prove that model of time series, of discharge coming out of that ground water is in the first order autoregressive model or Markovian’s first order model and brakeage period. In deterministic term of emptying reservoir is different than exponential care than the models can be proved to be second, third or higher order autoregressive models.

Section VI-I-3. Research topics G-3

VI-I-3.1 Characteristics of ground water .......... or systems by the depth of the water from the surface into the ground water. Because of the complex composition of rocky material in which ground water has been gathering or creating aquifers that structure of ground water is very important for its development and use in water resources project. One type of ground water .......... as a volume of available space
with a height of the level of the considering space element between two levels is of importance in different rocky materials also there is sequence of impervious and impervious layer or rock is important for ground water creation, filling and emptying. Ground water aquifers are of special importance in high regions between of the highest and the lowest levels of the rivers from which water infiltrates into underground and comes during the high flows of the river and comes out during the low flows of the river. These compositions of the ground water should be studied in function of how much water can be stored underground and how .......... of water can be changed from surface water to ground water into the return of ground water into the surface river flow. All banks of large river can create those shallow ground water fluctuation levels and influence the fluctuation of the river flow as well as how much water can be stored in every part of the year inside those water aquifers.

Section VI-I-4. Research topics G-4

VI-I-4.1 Mixing of underground in underground and thermal waters and infiltrating surface waters. In many areas disturbed by the tectonic of the Earth plates has been created thermal waters what means surface water infiltrating down to the warm parts of the Earth upper belt to the high temperature rocks heated as well as mineralized and coming out to the surface under the pressure of the infiltrated water on the other part of that thermal water system. Those thermal waters come to the surface in the form of mineral springs, thermal therapy baths, as well as mixing waters of different characteristics creating some kind of a new mineralization and new value of mineral waters. These mixing of the surface fresh and underground thermal water are phenomenon which has to be studied and create the method how to evaluate how much is the source of the heat material from the Earth crust and how much is coming from infiltrated water from the surface of the continent.

Section VI-I-5. Research topics G-5

VI-I-5.1 Effects on ground water by different layers of Earth surface as well as quality on dissolved minerals in water. The quality of water by dissolved minerals as well as temperature may explain many underground phenomena of influence of ground water aquifers which can not be studied from the Earth surface only, therefore there is need for describing type of the ground water and ground water systems and ground water aquifers. There is enough drillings and measuring of input and output for the water into the ground that can be classified as several new water types and aquifers. Especially the quality of the water under the influence of the mineralization can be of importance not only for health such as the diseases provoked by the quality of the ground water but also by the impact of the ground water quality on use of water for human consumption, animals, irrigation, health etc.
CHAPTER VI-J

H – GROUP OF RESEARCH TOPICS

Section VI-J-1. Research topics H-1

VI-J-1.1 Research topic related to water quality hydrology. As mentioned earlier water quality is hydrological property of water which is of importance for many water development and use. First of all one should study impact of water quality on the different uses and different place, that would increase the knowledge of information that use water, purify and so on.

Section VI-J-2. Research topics H-2

VI-J-2.1 Water quality and ..........of human’s animals and biological education cover. One should have enough information how water quality impact industrial use irrigation of the plants, use water for the food industry, human consumption etc. So one should generalize the knowledge of .......... and make systematic presentation of impact of different water qualities on the solution of water quality problems in different areas of the economy and other human .......... Water quality in the ----is of the costal areas of the World .By using chemicals in industry like fertilizers on the land to produce different types of crops as well as using chemicals in the water for washing in the house as well as for hygienic use on the water quality of rivers. An example is water quality changes in .......... in United States which area is considered as the most productive area on the sea of the sea food. In that case uses of the phosphate detergent I washing homes and washing yards and other parts cars etc creates water .......... saluted by those fertilizers. Also using monoculture production of the river basin of the estuaries can create --- pollution which would be cutting down production of the sea food and poisoning some of the species. So this relationship between disposing water between the uses in industries, cities, mines etc. can create pollution which can have tremendous consequences in using the polluted water. This would be standardized and made as much as possible known to designer and user of water by very well describing the quality.

Section VI-J-3. Research topics H-3

VI-J-3.1 The evaluation of cleaning water from primary removal of floating and suspending material which can be simply cleaned by filtering as well as depositing materials floating or standing in water, that would be considered as primary method of processing the cleaning of water. The secondary treatment would be by using the chemicals to fluctuate fine suspending material and settling the river basin with filtering and coordinating the water to sufficient quality to be used in industry and other less .......... criteria of use of water. The tertiary cleaning would mean removing either with chemical or other way the material dissolving water which is less usable for
special human consumption in cooking, washing as well drinking water, producing water based drinks and food. The quaternary processing of water would be to remove everything from water and getting clean pure H2O and add dispensing materials which are of importance for special uses. The fifth one is conversion from saline into fresh water on the small .......... for instance on the ships traveling oceans and as well on the costal area when converting saline into fresh water is cheaper then getting water from distant areas.

Section VI-J-4. Research topics H-4

VI-J-4.1 Accessing the state of the knowledge of how to use all of the five methods of converting polluted water or unacceptable water into those which are acceptable for particularly uses. To do this one should very well described how water is polluted as well as how they can be cleaned by one of the five methods of converting polluted water into the less polluted water.

Section VI-J-5. Research topics H-5

VI-J-5.1 Classification on the river flow as well as water quality on rivers and lakes according to the water quality

For instance first class River by the quality should be those which can be used even for drinking purposes. The second class would be water which is convenient for the use in food industry where any pollution of biological type can be removed by cooking or boiling the water. One should not forget the idea during the Ming dynasty in China when they decided to fight stomach diseases by using boiled water and cooked food. The third class river and lakes water are ones which can directly be used in industry and washing purposes. The fifth class would be rivers and lakes which are so polluted that they can not be used for anything except in emergency for washing purposes.

CHAPTER VI-K

I - GROUP OF RESEARCH TOPICS

Section VI-K-1. Research topics I-1

VI-K-1.1 Periodicity and almost ................. components tips hydrological time series. First of all one should find periodicity Earth phenomena and than periodicity and almost periodicity of influence of the Moon orbit around the Earth than the influence of
the Sun attraction and other factors on the processes of the Sun and the movement of the planets around the Sun so that one can tried to record movement as almost periodic in hypothesis than tried to see that there is harmonics which are interned of the observer time series and than find the frequency of harmonics and they ratios by the analysis and statistical text close to rational number that do not very different than the rational numbers in another words difference between estimated frequency and the closest rational numbers are not greater than did value in other direction that one would accept that those are periodic movement in the opposite .......... is proven that one could consider that periodic movement almost never repeat itself .......... predictable one should simulate many almost periodical movements of interest in hydrology and see what is expected in near future say from next day, next month, next year, next decade of years and so on after about one million years. So depending on the character of almost periodic movement what it ................. pleasures.

**Section VI-K-2. Research topics 1-2**

**VI-K-2.1 W.................** Modeling stochastic component after the tendencies in parameters intermittency in values of the series and interest on periodicity ............... are taken care off and removed from the series one should have approximately stationary stochastic process one should test stationary strongly as possible and develop method from different stationary component precipitation, vaporization, ran and other types of hydrological time processes in another words in interest on stationary ............... of interest and criteria ........... should be developed and standardized. This would be particular aspect of research on that research topic.

**Section VI-K-3. Research topics 1-3**

**VI-K-3.1 W.................** Develop method to study how the impact of extreme invents on the life large meteorite hitting the earth in different ways and different positions and different characteristics of both areas which was hit and body which hit the earth.

**Section VI-K-4. Research topics 1-4**

**VI-K-4.1 W.................** Periodicity and almost .................... components tips hydrological time series. First of all one should find periodicity Earth phenomena and than periodicity and almost periodicity of influence of the Moon orbit around the Earth than the influence of the Sun attraction and other factors on the processes of the Sun and the movement of the planets around the Sun so that one can tried to record movement as almost periodic in hypothesis than tried to see that there is harmonics which are interned of the observer time series and than find the frequency of harmonics and they ratios by the analysis and statistical text close to rational number that do not very different than the rational numbers in another words difference between estimated frequency and the closest rational numbers are not greater than did value in other direction that one would
accept that those are periodic movement in the opposite is proven that one could consider that periodic movement almost never repeat itself predictable one should simulate many almost periodical movements of interest in hydrology and see what is expected in near future say from next day, next month, next year, next decade of years and so on after about one million years. So depending on the character of almost periodic movement what it pleasures.

Section VI-K-5. Research topics I-5

VI-K-5.1 W.......... Modeling stochastic component after the tendencies in parameters intermittency in values of the series and interest on periodicity are taken care off and removed from the series one should have approximately stationary stochastic process, one should test stationary strongly as possible, and develop method from different stationary component, precipitation, evaporation, ran and other types of hydrological time processes in another words in interest on stationary of interest and criteria judging whether series are station or not, should be developed and standardized. This would be research topic on particular aspect of research.

Section VI-K-6. Research topics I-6

VI-K-6.1 W.......... Develop method to study how the impact of extreme invents on the life, large meteorite very rarely hitting the earth in different ways and different positions and different characteristics of both area of impact and character of the body which impact the earth. Also how the influence of the large phenomena of rare occurrence of the earth carst on entire Earth many in hydrological time series. So it should be develop of methodology to study different hypothesis of the impact of the still into sonar system on the anterior of the Earth of the eventually influence of hydrological processes.

Section VI-K-7. Research topics I-7

VI-K-7.1 W.......... Search for eventually other physical characteristics of hydrological processes which are not included in tendency, intermittency, periodicity, omor and stochastic as well as rare event impact but can be considered as different physical processes of those five. One should look for every possible physical influence of that time and tried as can be consider as independent influence of the other five characteristics. Extremicity and than eventually seven or six physical impacts on hydrological processes. Research topics which have to be included in some of the term of so groups which have not been included previously.
CHAPTER VII-L

J - GROUP OF RESEARCH TOPICS

Section VII-L-1. Transport of the goods by the water pipes

VII-L-1.1 They are five communication traffic lines first of all... part to land passengers especially for workers caring on their back from work and animals, horses, so one caring the woods. Next one is the road, cars and be used as well as now automobiles and trucks. The third one is real roads and different sizes and different types and fourth one is the navigation routes: rivers, likes and canals. And the fifth one is airplane transport on long distances of humans and goods. One meted of transporting goods which has not been develops systematically is transport water by pumping water with mix materials transported from one point to next point. In that situation for instance in concentrating all materials before there are processes there are grinding so that the water in co... can carry them also needs another similar crops and transporting the water .... no damage in the friction between materiel among themselves and contour of the cube pipes. The transport by water pipes is very interesting for water resources and hydrology. At of all the sources material of transport has to be very well design, standardized for long period of time. Second there should be enough water on place and start pumping after the place where water is material discharge. Idea is when both transporting material and water using transportation are both needed at the place on discharge. In some cases there is no water at the place of entrance one could be use only one filing and have be double pipe to return the water by the second pipe and than used same water several times. Availability of water at the point of departure and the point discharge are very important factors. One example for instance which could have been done is transporting brain of the potash salt from Saskatchewan large deposits one mille deep deposits, about 11 meters feet layers of mixture approximately half and half of or ...... salt and potash salt. That would have be done by transporting the brain from Saskatchewan to the western coast to Mexico special structure which would be crystallizing the potash salt packaging and labeled this is practically unable by pipe and large sea ships to get potash from that tremendous layer in Saskatchewan to all around the world to the land which needs potash fertilizer. Another example is, for instance: hard wheat crops of Colorado which has use in Japan because of the special character of the grain of hard winter and crops of wheat. One would transport wheat in pipes from Colorado up to the California, Oregon and then overt here would drive wheat packages in proper way and order ships for the time. This idea should explain how should this new the sixth line of transport of good like infrastructures should affect hydrology.
CHAPTER VII-M

K – GROUP OF RESEARCH TOPICS

Section VII-M-1. Influence of the type of spillway on safety of dams as well as influence of the destructed dam bridge dams on hydrological processes downstream

VII-M-1.1 Some close spillway has discharge of flood and the function of the spill height close evacuation tunnel on the power one half. While two other spillway either over the dam three surface spillway on the sides of the dam have discharge as a function of the height of the spill height on the power three half. In this situation one can design spillways always for lower levels of the reservoir in floods propose and than for higher levels for the reservoirs and air floods have the surface water going over the resurface inlays. Also the type of the dams how the dams are destroyed by the floods in natural conditions or by the man made sabotage or errors in construction. This second aspect of the reservoirs and the dams should be studied from the point of view what kind of openings and what type of the consequences on hydrology are made by designs. For instance for large arch dam minimum sickness of the arches selected dam before it can be shown can only make openings in the dam site in water for reservoirs while dams are practically the same however as soon as mass uses gravity dams or arch gravity dams or other concrete dams as well as the Earth fill rock fill dams are practically once made and have much larger influences on hydrological processes. This should be very well studied how hydrology downstream and how the reservoirs are emptied and what’s happened with the hydrological aspect of river cross section.
CHAPTER VI-N

L – GROUP OF RESEARCH TOPICS

Section VI-N-1. Influence of the natural material coming from the side into the river and create temporary or permanent obstacle creating upstream reservoirs later filled with sediment and having completely change hydrological condition of entire section of the river.

VI-N-1.1 This should be studied from several point of view and how one should treat the material falling into the rivers from the time and different solutions on influences on hydrological processes. Similarly is a height of the river material falling into the reservoir the material they the volume of the water falls on to the reservoirs and creating potential without having reservoir destroyed. However, one should study their influence on reservoirs their destruction and consequences for hydrological processes of the river.
CHAPTER VI-O

M – GROUP OF RESEARCH TOPICS

Section VI-O-1. For the studying non homogeny in Parameters Rivers and lakes having tendencies in parameters

VI-O-1.1 The............... Apart the study how the symptom tendencies in parameters have been obtained by human natural processes one should study how parameters are changing even how mathematical models are changing with different sources with non homogenate as well as how long large periods of implementation of some measures and then how .......... measures of non homogenate are influenced. What are the lowest of non homogenate in series how they can remove or postpone in time period either original or one ............. and homogenous. The question of non homogenate in hydrological series is the source of conclusion about the flood values, drought condition as well as other water hydrological characteristics is very important factor for both hydrology and .......... in solving the problems.

VI-O-1.2 Remarks on research topics. Research topics may be considered as daily research, --research of different and then general estimate of approximate values of some measures of hydrological characteristics as well as impact of those characteristics on water resources solutions. Basically research can be considered theoretical, mathematical or physical deterministic or stochastic as well as experimental either in hydrologic and hydrological laboratories as well as hydraulic water resources models. The other basic research is practically physical experimental. As all these research hydrological researches and processes especially changes in water quantity and water quality in four dimensions as well by the use of water and water resources development and control and protection.

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CHAPTER VII-P

N - GROUP OF RESEARCH TOPICS

Section VII-P-1. Rainfall input

VII-P-1.1 The ................. There is a model done under the ................. simplification of the shapes and slopes of the river basin as well as the differences in distribution of precipitation rainfall minus evaporation the physical modeling has been very simplify and you very often in predicting run of from in floods from extreme rainfall. One should extend physical modeling of the river basin physical, stochastic, physical of the deterministic stochastic modeling. Mainly to have the characteristics of the response measured by some parameters of some other way show that it can be related to the corresponding parameters of rainfall and meteorological other variables. That response of the river basin is the function of the surface of the characteristics of resistance of water retention, evaporation and other factors. That entire philosophy of deterministic river basin response as unit hydrograph should be very well questioned and tried to be more realistic physical factors of the river basin and precipitation.

CHAPTER VII-Q

O - GROUP OF RESEARCH TOPICS

Section VII-Q-1. Using large number of data on experimental river basin for deriving hydrological regularities

VII-Q-1.1 The ................. USA Government agency ......................... conservation service, agriculture research service, forest service, corps of engineers, offices, reclamation offices and regional offices as well as other agencies has spent about three hundred million dollars in establishing experimental river basin small basin as well as observing data. What have been derived as generalization of knowledge as new river basin and new problems in relatively very much limited. Tremendous amount of data exist in the files in computer memory of data files. That should be reviewed together with all those agencies and find the way how the research should be done to .......... maximum information for use all agencies and private consulting firm and other users of hydrological data. That is real that couple of million dollars may hundreds of million dollars and justify why such amount about three hundred million dollars spent in establishing observing data in experimental river basin.

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CHAPTER VI-R

P – GROUP OF RESEARCH TOPICS

Section VI-R-1. Abusive and atlas of hydrological and hydro-meteorological characteristics of USA and their ................ possessions

VI-R-1.1 The..................... One can tell hydro-meteorological variables like the mid of precipitation, standard deviation or coefficient to variation or other parameters visionalyzed by different time interval series and of isolise of the mass also evaporation from the lakes and reservoirs can also generalize by using data of observing evaporation under different condition and .................. their parameters. The river flows can be observed on thousand stations and their parameters on different time series can be also obtained and regionalized. Maybe one should take into account to new data or up to about two thousand ten years or two thousand twenty years and by that time produce an atlas which would held maybe five hundred maps of isolise of different explanations and giving .................. information how the regionalize parameters are defined and obtained and how the data could be used. This would be generalization of all information which have been done on hydrology and associated variables in the USA.
Proposal for creation international library in English language for water resources technology and development

Highlands Ranch, Colorado, USA
2005
PART IX PROPOSAL FOR CREATION INTERNATIONAL LIBRARY IN ENGLISH LANGUAGE FOR WATER RESOURCES TECHNOLOGY AND DEVELOPMENT

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CHAPTER IX-A
CREATION INTERNATIONAL LIBRARY FOR WATER RESOURCES TECHNOLOGY AND DEVELOPMENT

Section IX-A-1. Creation the international library

IX-A-1.1 Reason for creation the library. Water resources problems of the world are the most important problems special in development countries and countries where finding population is very critical. So complex are uses of water and benefic and dangers of water in the nature are so complex that need most modern technology of uses. As English language as become in dominate language in the technology and science in the world because more then tree fourth of all literature in this area in particularly in English language. The reason for English language becoming such and important language are to first that not only the most of literature language already but also the most of specialists in the world in water area are verily English language in wonder to be able to used the language literature and its self for professional work. The second reason is that the library could be produce in to ways: in paper type as well as electronic type and could be duplicated on request hider in entire books or in parts in book or add documents.

IX-A-1.2 How the library would be creating. It is assume at if nice proposal as been written on the value and way how the library creating and used that finding from the national research finding, technology finding and development finding organization would be supported. The organization would be no profit association for organization of many interaction institutions of many countries as well as supporting by lading scientist and engineers in the world. Because United State in producing in the maximum literature it be logical that this organization composed of interaction members would be locates in the United State with different comities spread on round the word having members ship from all the countries which have talents to give....goes committees. The most important comities would be selected in any language the best books to be publics in on English language and published on all form: papers and electronics. The corporation makes college books or sector of books or title of books contract international publishes of sacher books and make agreement of pricing shers of books, number of publishing books and so long. The organization, no profit organization, would be support by donation .......... the publishing of the book. The center of the book will be location in one of European or American University or institution which should give physical support what mines library space, furnishers, administration and operation. Varies institutions in the word educational or technical or since would have to be members of library in node to enjoy full use of the library. Namely to be able to preachers to descant prices of books or electronic types storage should be able to perches chapters, subchapter, or parts of pictures or grafts or so long of the books.
Section IX-A-2. Type of books including in library

IX-A-2.1 Two types of the sorts of the book. One sort of the book will be all present of the book a viable to review in any language by primary by English language. Those books will be in the new interaction commit of not profit organization in about language: in English and original language. The Books are recommended will be to types: one will be the book just reprinting or publish as it is in nadir corrections, and the under one will be books translate corrected and than pumplipad and jested in present times on noliges in publishing book and present. Those books from past translate abdaging and publishing and new will be carry special numbers and special colors of the hardbound and soft bound hardware.

Section IX-A-3. Proposal for books including in international library

IX-A-3.1 The France books. The books in France language in water properties in all adder state in wait fourths engineer of nerting publication in Franc language on all property of water bit contest, grafts and so long give me information about how use water in different way. That book would surly enter to selection of the book in paste to carry in future. However it have to be translate from French to English and updating giving some more property specially suspending on flowing suspending on water sources carry for materiel different than water. Also some under property has given the books. That would carry number one for ristenc of past the books prepare for future.

IX-A-3.2 The France books. The IX-C-2 Flood mechanics by Prof. Hanter Rauns. The flood mechanics painting by Prof. Rauns is fames book which will be very easy adjusted with new contributions in mine time to fluid mechanics of application of different areas water resources development. Some of thinks students or under professor how update the book and prepare for publishing and second book to the past caring to future.

IX-A-3.3 The Italian books. The IX-C-3 Italian books Hidraulika 1 and Hidraulika 2 by Djulije Demarki professor of University of Milan. By many hydraulic engineers this books is consider as the best books in hydraulic ever written in any language. It should be easy to find in Italian hydraulic professor or Italian engineers in practice how can update the books and prepare for future use and translate to English language and publishing. Similarly under areas of the books on flood control, draut control, irrigation, drainage, hydro power utilization, water supply of cites, humans, animals, industries, recreation, ... as well as other uses of water.

Section IX-A-4. Future has written books

IX-A-4.1 The............................ The other group of books in start in year in which the no profit organization establishes future written book in water area selecting enters to library.
IX-A-4.2 **Selection of manuscripts.** Water has to submit manuscript to no profit organization and that corporation would give the book for review to every comity which have interest such the books and complements to valued. The book prestezen to very water consider very rivoding ......................................................

Acting then no profit organization would help to finals translation and editing on English book. This book to selecting and publishing international companies and would had on year of the publishing as well as the power of the hydro soft hardware pages.

Section IX-A-5. **Financing of the library on water resources development**

IX-A-5.1 **Financing of the library on water resources development.** E.............................................

Section IX-A-6. **Water resources technology as well necessary other natural resources**

IX-A-6.1 **Where foundation of industrial countries which finals studys of natural resorssis.** Every industrial large country in world as foundations or institution or divisional other institution which have concern with financing research and investigation of natural resources save. Minerals, timber, soil, water, flans, medicinal flans used for animals, lens and human as developing fours. Well documented proposal 25 million dollars for period of 10 years by some very large University of the world after forming as special international comity supported by United Nations and UNESCO and other United Nations organization to prepare the proposal.

IX-A-6.2 **Composition of the proposal.** The proposal should outline the antarered period on 10 years with financing every year proposal action. The meager support to library will be from publishers how one part would of sale the book will be given authors honorary as well as expenses on no profit organization. Also the library will be supported by selling the book on the discount price as well as coping bought electronic and paper type book at the price as well as other services library can provide. Every country which would support no profit organization and operation of the library should have right to copy only its one text every single library in his procession. The center library would have governing body appoint by United Nations specially UNESCO as well as by the mainager donation institution how fund the operation of no profit organization.

IX-A-6.3 **Operation of the library.** The library will be govern by bode appointed as well as by sector of special comities which should be international selected. The manger comity would be selection of the past book to update and translate in English and publish. The secant comity would be selection on new book with translation, correction and updating. The third comity will be on the selection of people how would be translated as well as editing and updating. The four comities would be selection of the area cover by
the books. The five comity advisory booth which would be advisory of the director of no profit organization how would be selecting by booth of gavreming bouth on no profit organization. Title of the organization should be world library for water resources development technology.

**IX-A-6.4 Information.** From time to time writing reported on library states success progress negative aspect difficulties, financing and etc. Save every 10 to 25 years library would be describe how it progresses and how it fites with problem spose.