

## **ADAPTING AND IMPROVING RESILIENCE TO CLIMATE CHANGE IN COMMUNITIES (MORAVIAN COMMUNITY AS A PILOT), BY CREATING NEW CAPABILITIES BASED ON THE IMPLEMENTATION OF A NEW WATER CULTURE; PROTECTION AND MANAGEMENT OF NATURAL RESOURCES**

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**KEY WORDS:** Environment, water, communities development, “Hacia una Nueva Cultura del Agua”, Dr. Pedro Arrojo Agudo, Costa Rica.

### **ABSTRACT:**

Water, in all its dimensions and scope, concerns humans as civilization, individuals and communities immersed in an environment that faces serious environmental threats and changes. The efficient way to deal with this crisis is education of present and future generations, breaking paradigms, creating awareness and new development models, seeking community groups and forces to empower their water resource and care, manage and renew it in an efficient and sustainable manner. The multiple uses of water in personal uses, irrigation, agro-industry and clean energy production, transforms this resource in a strategic element to any nation. With support from the Centro Nacional de Alta Tecnología (CeNAT), it was possible to formulate the “Agenda Ambiental de Moravia”, agreeing to be the “Consejo Técnico de Fuerzas Vivas” (CTFV) from Moravia - articulated network of stakeholders – the one that coordinate all actions referred to water Resources, pollution and cleaner technologies and protected Areas. CeNAT and CTFV have developed distinguished efforts to improve the Moravians quality of life, and this has led the initiative of constitution of a whole education and training project in rescuing the Upper Basin of the Río Tárcoles, through the implementation of an ecological – recreative garden (“Parque Comunitario Pulmón Verde de Moravia”), fostering good use of natural resources, and also works as a platform for training and awareness program in Sustainable Development, based on “Hacia una Nueva Cultura del Agua” (powered through the United Nations by Dr. Pedro Arrojo Agudo and his “Feria de Aguas, Ríos y Pueblos”, presented in many countries). This initiative is projected to the national and international communities, through the “Water International Conference”, which propel initiatives, laws and decisions which enable the development of Costa Rica and other countries under a sustainable model, focused on this essential component for life on the planet.

## I. INTRODUCTION

### 1. World Situation:

We can define the term adaptation as "adjustment in natural or human systems in response to actual and expected climatic stimuli or their effects, which moderates harm or take advantage of opportunities" (IPCC, 2007).

In addition, we can define vulnerability as the "degree to which a system is susceptible (sensitive) and unable to cope with the adverse effects of climate change." (IPCC, 2007).

It is estimated that by 2008, 1,200 million people lacked access to safe water, projecting, into the 2025, to 4,000 million if it continues the processes of widespread degradation of aquatic ecosystems, driven by current globalization trends. This actually leads to the death of about 10,000 people for this reason, most children.

As indicated by Dr. Pedro Arrojo Agudo (Agudo, 2008), the problem is not the shortage, but the quality of available water due to degradation of the natural environment for the simple desire and simple profit and power. This leads to three major points of crisis or failure in water management:

1.1 Sustainability crisis: it raises movements in defense of territory and aquatic ecosystems from the construction of large hydraulic works, deforestation and pollution of rivers, lakes and aquifers;

1.2 governance crisis: it generates movements in defense of human rights and citizenship, against the privatization of basic water and sanitation;

1.3 coexistence crisis: in the measure than water is seen as a confrontation argument, instead of assuming the management of rivers and aquifers as a space for cooperation between coastal towns.

As Al Gore stated in his now famous documentary "An Inconvenient Truth", climate change leads, according to the current trends, to three critical issues that directly affect water resources: (Gore, 2006; Arrojo, 2008)

a- progressive growth in average temperatures;

b- regional changes in rainfall; with increases in some places and recession in others;

c- increased climatic variability, which behave droughts and more frequent and intense storms.

### 2. Situation in Costa Rica:

The Energy and Environment Ministry of Costa Rica has as the objective of adaptation, reducing the vulnerability of the most susceptible sectors.

According to World Bank's study entitled "Natural Disaster Hot Spot" (World Bank, 2005), which presents an overview of disaster risks related to natural hazards (droughts, floods, cyclones, earthquakes, others) - Costa Rica is the 2<sup>nd</sup> most exposed country to multiple hazards in the world (a total of 36.8% of the total land area is exposed to three or more adverse natural events).

In addition, Costa Rica is the eighth most likely to suffer economic risks due to greater exposure to three or more natural disasters. Additionally, the Instituto Meteorológico Nacional (IMN), -responsible of national communications to the United Nations Framework Convention on Climate Change-, has made a special effort to contribute to the scientific basis to support decision making regarding climate change by conducting vulnerability studies in coastal areas, water resources, agriculture and ecosystems in the country.

According to the Ministerio de Planificación Nacional y Política Económica, "During 1988 – 2009 period, Costa Rica presented losses totaling \$1,823.3 million. The events with higher recurrence and that caused significant damage throughout the period, are 34 hydrometeorological events (82.9%), among which 32 correspond to excess of precipitation and two precipitation deficit or drought. "(Ministerio de Planificación Nacional y Política Económica, 2012).

We can to emphasize an increasing trend in the number extreme events in the period 2005-2009 (40% of the events identified in this period). The losses at that period are \$ 187 million (52.4%).

In 2005-2011 period, Costa Rica had a total of US \$ 106.6 million / year in losses. (Flores Verdejo, 2012). This according to the agreement between the Ministerio de Agricultura y Ganadería (MAG) and the Ministerio de Planificación (Mideplan) signed in 2010, which was taken as reference regulators emergency response plans of the National Commission Emergency (CNE).

"Adaptation is a strategic agenda for the country" (MINAET / EPYPSA, 2012). The agenda on climate change is at the highest level of national and international commitment in the country.

Costa Rica ratified the 2002 Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) by National Law 8219. Our country intends to take a leadership role on the issue of climate change with a commitment to become a carbon neutral country by 2021.

The country developed and adopted the Estrategia Nacional de Cambio Climático (ENCC), whose objective is: "to reduce the social, environmental, and economic impacts of climate change and take advantage of opportunities, promoting sustainable development through economic growth, social progress and environmental protection through mitigation initiatives and adaptation actions, for that Costa Rica improves its

inhabitants and ecosystems life quality, to move towards a low carbon economy and competitive by 2021. This shared responsibility should be given through capacity building and legitimacy to influence both the National Agenda and the International Agenda "(Ministerio de Ambiente, Energía y Telecomunicaciones, 2009)

The ENCC considers the adaptation to climate change to reduce the vulnerability of key sectors and regions as one of its strategic priorities. In addition, it focuses on reducing vulnerability and risk to the impacts of climate change in priority sectors: water, agriculture, fisheries, health, infrastructure, coastal areas and biodiversity. The water sector has particular interest for this article.

Within the territory of Costa Rica, water is intended to solve established needs (hydropower, water supply, irrigation and drainage), according to studies developed by MINAE, which address that negative effects due to climate change and flows reduction or excessive increase can result in economic loss or health problems and lack of hydropower. This is also reflected in the exploitation of water resources for irrigation and human consumption as well as the design of water supply and sewerage systems.

The people needs for supplying reliable and clean water are not fully met, due to lack of policies integrated water management (MINAE, 2008). According to this study, in most regions decreased rainfall is significant when considering economic activities that develop.

This leads, urgently, to consolidate the integrated management of water resources in the greatest risk areas, just to prevent risks and to rationalize this valuable resource. It is important to note:

a. The volume of water for irrigation is critical to maintain important crops throughout the country. This is particularly important for food security agenda of Costa Rica.

b. Increased demand and supply reduction potential of water resources due to climate change, together with the effects of extreme weather events, leave the country in a state of high vulnerability. It should be noted the work of the Asociaciones Gestoras de Acueductos Comunes (ASADAS). The service they give has a very significant impact in the communities they belong and are success organizations that are directly related to health, economical development, and with an integral management of the water resources. (Instituto Costarricense de Acueductos y Alcantarillados, 2012, Dimensionamiento de las ZMT)

The Costa Rican coast covers over 1,100 miles along the Pacific Ocean and 200 km along the Caribbean Sea. It is afraid a progressive increase of up to one meter in the sea levels from the current level, according to IMN and National Meteorological Institute and the International Ocean Institute (IOI) estimates.

The German Agency for Development Cooperation (GIZ), supports the Sisetema Nacional de Áreas de Conservación (SINAC) from MINAET, through the project called "Coastal Marine Biodiversity in Costa Rica, Capacity Development and Adaptation to Climate Change". It was based on studies on the shores of the country and Central America. This study denotes direct effects on many kind of habitats due to climate change. (BIOMARCC, 2013). CeNAT has worked directly into this project.

It is a fact that all the social sectors are directly affected to the extreme climate changes, respect to food and nutrition security of a nation. Health and basic needs of the population are linked to access to water resources, so their quantity and quality depends on the personal welfare of many.

According ECLAC, Costa Rica is in the 69th in the Human Development Index for 2011, considered highly developed. However, this Report, warns that environmental threats could overshadow the achievements of the country and the region, making it impossible to achieve new breakthroughs. "This socio-economic vulnerability of Central America is exacerbated by its geo-climatic location on an isthmus that bridges two continents, rich in biodiversity and variety of ecosystems, located between two oceanic systems, the Pacific and the Atlantic, with their corresponding climate processes". (ECLAC, 2011).

## II. ACTION PLAN AND IMPLEMENTATION

### 1. Pulmón Verde Community Park - Moravia

The Moravia Canton has a Consejo Técnico de Fuerzas Vivas (CTFV) - articulated network of stakeholders, formed voluntarily by representatives of local government, public institutions and civil society organizations – that have been working since one decade ago in solving their problems and to improve the Moravians life quality. They have defined their work axes areas: Environment, Health and Socio-Cultural.

CTFV has worked directly joint with the CeNAT Environmental Management Department- university consortium for research and development - who have provided scholars, researchers, theses and community college students work, supporting work in all 3 axes defined before. It was possible (also sponsored by CeNAT), to formulate the Moravia Environmental Agenda, which was presented to the City Council in December 2004. It was agreed that it is the CTFV who coordinate all actions under this agenda. This agenda has defined: Water Resources, Pollution and cleaner technologies and Protected Areas.

The CTFV, has been working for more than a decade with CeNAT, developing distinguished efforts to improve the quality of life of the community, and this has led to the initiative of establishing an entire project

for education and training in the rescue of the Upper Basin of the Rio Tarcoles, through the implementation of an ecological- recreational Garden ("Pulmón Verde") through which not only good use of natural resources is conducive, as is the forest and streams, but also serves as a platform for a whole program of training and awareness on Sustainable Development, based on a New Water Culture (powered by of United Nations by Dr. Pedro Arrojo Agudo) and projected to the national and international community in different areas.



There have been developed Environmental Education Programs focused in the water resources, as the community has three streams that cross it: Quebrada Barreal, Quebrada Chiquita and Quebrada San Francisco.

These programs have been geared towards community action, by which is meant that small farmers in the upper area of the basin located in San Jerónimo, make the most of their agricultural waste by generating manure or compost and the community, has launched the "Separate and Recycle from your Kitchen" Program, which is operating in two neighborhoods. This program is intended that the Homemaker separate and recycle their waste from home. The Association for Development of these two districts are responsible for conducting the census of the confirmed homes and the path of travel of the collection truck is established. Funds derived from this activity are reported as resources to the association, representing healthy income to be preferably used in environmental projects in neighborhoods.

In order to contribute to the aspiration of being carbon neutrality in 2021, Bicentennial year, the Ministerio de Salud through a cooperation agreement between it, the Municipality of Moravia and the Unión Cantonal de Asociaciones de Desarrollo de Moravia (UCAMO) signed on June 16, 2010, ceded a land they belong to the creation of the Parque comunitario de Moravia Pulmón Verde (Moravia Green Lung Community Park), which has, as main objective "to contribute to the quality life of the Moravia community"

"El Pulmón Verde" from Moravia will promote Sustainable Human Development, for the Moravian habitants and neighboring districts in other cantons; It

was directed at implementing activities of formal and informal education, training for residents of communities, foster the creation of productive learning units and foster the development of eco-tourism activities where it will safeguard and make known national biodiversity.



Plan Moravia  
Pulmón Verde

## 1.1 Architectural Components

### Zone 1: Community Assistance and advice

A Pedestrian and vehicular access to the park area establishes the connection to the external environment and due control. A screen shot at the end of the the public access road generates intimacy to the project and perceptual and spatial extent. In this area the internal flows are distributed to the rest of the zones.

### Zone 2: Communal educational Brainstorm Centre

It is destined to host children's recreation functions, administration and training. It will has a Multi-purpose Hall, equipped with a service and maintenance area. Their reason is training and exchange of ideas among the community.

### Zone 3: Market Area (Urban Agriculture)

In this space, community residents may produce and market their own agricultural products obtained with friendly farming techniques with the environment. They can learn organical techniques and apply them domestically. An open market is established. Production and training, access to an activity.

### Zone 4-5: Hydroponics (communal vegetable production)

It is a communal production area in which people can take use of hydroponics technique, which offers many advantages for domestic use. Therefore training in the use of this method were also given and the production is marketed in order to maintain activity and benefit the community.

### Zone 6: Social Communication

It is focused on communication and information transmission, functioning as a platform for cultural and

artistic expression as well as community organization or educational and recreational use of high school, visitors and researchers groups.

### **Zone 7: Navite Flora and Fauna Experimental Station**

It is an open ecosystem, designed for the birds, butterflies and other insects convergence, through the use of carefully selected plants with enough attractive for them. Through it will be possible to guide experimentation and research.

### **Zone 8: Gallery Forest. Oxygen factory**

It is a Reforestation Project for the native ecosystem area, to create a suitable habitat for the development of species. It is a production lung of oxygen and CO<sub>2</sub> disposal. It is also a didactical forest.

## **2. A New Water Culture:**

Furthermore, due to national and global panorama that is emerging from climate change and the rapid depletion of water resources, CeNAT have been promoting programs and projects on the theme of water. We have worked with Dr. Pedro Arrojo Agudo, professor at the University of Zaragoza, world authority about water, an expert consultant to the United Nations on the subject of water, and creator of a concept, called the "New Water Economy", economic theory with a totally friendly base with the environment, and that earned him, the Goldman environmental Prize (equivalent to Nobel in the subject) in 2003.

This proposal, focusing on the ethical reflection, starts from the fact that there are various water uses and diversity of rights to it, but some of them have more ethical value than others. He proposes four dimensions, with the following order of importance: (Arrojo , 2008)

- Life – Water, at basic survival functions of both humans and other living beings. It must be recognized and prioritized so that the sustainability of ecosystems and universal access to basic water quality assessments as a human right is guaranteed.

- Citizenship – Water, in activities of general society interest as a whole; ensuring health functions and social cohesion (such as urban water and sanitation); must be placed in a second level of priority, in connection with the rights of citizenship, linked to the respective responsibilities of citizens.

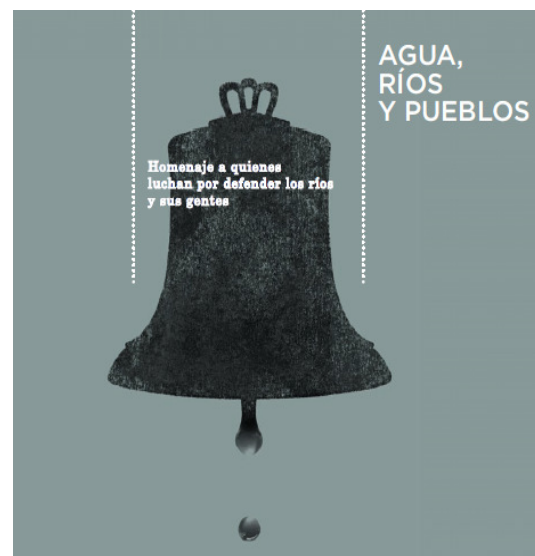
- Growth – Water, with economic functions of productive nature; should be recognized as a third priority level, in connection with the right of everyone to improve their living standards. This is, in fact, the function in which most of the water from rivers and aquifers is used, and that are derived the most important problems of scarcity and pollution.

- Crime – Water: illegitimate productive uses, if not illegal (discharges pollutants, abusive extractions ...) that harm the general interest of society. Such uses should be avoided and prosecuted through the rigorous application of the law.

The ecosystem water should also be calculated and returned to nature, to sustain its vital role in different ecosystems of the country.

CeNAT coordinated a Dr. Arrojo's Conference at the Omar Dengo Foundation, at 2012, attended by representatives of Government (including the Vice President and Minister of Science and Technology), non-governmental organizations and private companies, which became aware of the adoption of clear and precise policies which enable the development of our communities on a basis of justice on water.

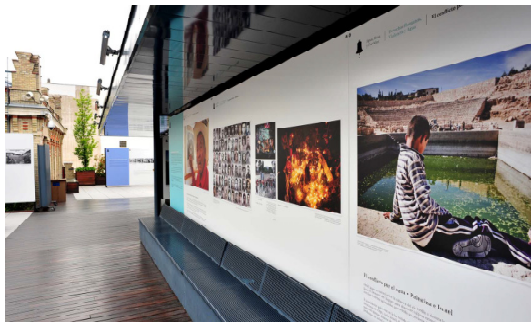
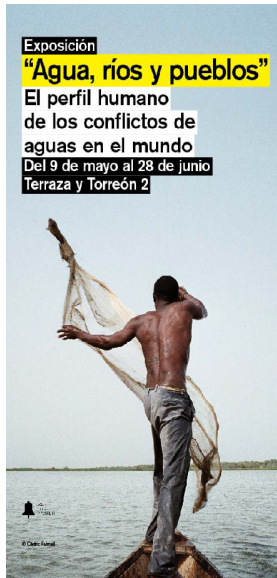
Dr. Arrojo has become an international traveling exhibition to educate and train communities in these areas, called "Water, Rivers and People Fair", which has been presented in many countries (including Spain, Guatemala and Peru ).



(Arrojo, 2012)

The twin objectives of "Water, Rivers and People Fair" is awareness society and empower social movements.

Awareness from direct contact with problem sufferers frontline; a contact that seeks to involve multiple stakeholders. This exhibition seeks to encourage debate and concrete commitments, creating a citizens' agenda, organized by social and political movements themselves, which empowers citizen movements and get them to be conscience of the issues. Thus, the Fair promotes local, regional and national case studies, which let them to know close issues and encourage the debate and citizen action on them.



(Arrojo, 2012)

This fair will be brought to Costa Rica and exposed in different social, community, university and national centers, in a coordinated way with the "International Congress of waters" in order to raise awareness, sensitize and motivate the national and worldwide meeting about water resources.

### 3. International Water Congress

Finally, all these efforts must go beyond the community level to impact at national and international levels in the different government and community spheres.

In fact, it is necessary and urgent a national approach on this issue, to analyze the Law Projects about water at the Asamblea Legislativa, to value the Dr Arrojo proposals, and also offers lessons on the action of the community of Moravia in the water issue.

On the other hand, it is time to expose the national and international community the truth about the world's water resources, the main research and discoveries in the field, and put governments and schools face to face with communities and NGOs, with the purpose of generating solutions and international policies and promote synergy to motivate a change in world politics, looking for a truly sustainable development for humanity, based on Water Economy proposed by Dr. Arrojo.

It seeks to achieve by performing an "**International Water Congress**" component in which the different groups be involved, both government and academia, research centers, communities, NGOs and other relevant national and international agencies.

This five days International Conference, is projected to November this year and will feature:

- Research oral presentations about main researches of water resources.
- Parallel exhibition of posters and, at the same time, the "Water, Rivers and People Fair".
- Socio-economic and political presentations and analysis on the issue of water resources.
- Four training workshops to communities and social at groups and who have developed self-sustainability, mitigation and resilience to climate change and its impacts on water resources projects.
- Two discussion panels for decision makers and international cooperation and support agencies. It is expected to generate and to promote proposals for national and international policies with the relevant authorities.
- A final discussion forum and closing.
- Post-event monitoring and results evaluation processes.

### III. CONCLUSIONS

While we talk every day and in every conceivable media about water resources situation, many sectors (particularly industrial and other power groups) take climate change as a myth and expose it as a tool of certain groups to stop development.

However, as we have seen in the previous information, it is undeniable that we are degrading natural aquifer sources are altering ecosystems not only to industrial processes without control, but by the lack of making concrete and direct decisions and actions by part of communities, governments and international NGOs.

Costa Rica is at a more moderate line and conscious subject, but lacks definition of policies and concrete actions in which can be possible to work and develop.

The New Economy of Water outlined by Dr. Arrojo emerges as an important alternative in which a real balance between all sectors is proposed and the integral development of water in all its aspects is discussed.

It is urgent to open awareness, dialogue and defining strategies spaces, such as those presented by the upcoming International Congress on Water, in which

the triple helix actors (government, academia and centers / research organizations and private sector) take part, together with communities, to take the decisive step that leads the world to real and restrained social, economic and political solutions and involving the general good of mankind.

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