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# A NEW TYPE OF MONEY FOR A MAYAN COMMUNITY TO BUILD RESILIENCE IN A CONTEXT OF ECONOMIC CRISIS

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**ABSTRACT**

We present the proposal of a complementary currency, the Sodziles, to strength the local economy and social ties among the members of the Mayan community of Sodzil (Campeche, Mexico) that work in a mangrove restoration project. This project is important both for the conservation of mangroves and for the social and economic dynamics of Sodzil community. The Sodziles are backed by the restored mangrove ecosystem. We describe key local environmental, social and economic aspects, as well as the macroeconomic context within which the project is developing, specifically, the credit expansion and level of indebtedness in the various sectors of the country, and especially in Campeche State, where the restoration project is in process. From there, it was possible to identify that Mexico is close to a strong economic recession due to the high level of indebtedness of the sectors of its economy. The occurrence of this crisis may affect government funds to finance the restoration project, as well as economic activities such as construction works on which some of the Mayan descendants depend. There is no crisis yet, but it is important to consider the Sodziles as an option in case this crisis happens and also to ensure that the recovered mangroves are protected.

**KEYWORDS**

Dollar standard, mangrove restoration, complementary currency, Maya community, money backed by mangrove restored areas

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## 1. INTRODUCTION

To propose viable solutions to complex socio-ecological problems, it is necessary to conduct the analysis by considering different perspectives (ecological, economic and social, for example) as well as multiple appropriate temporal and spatial scales (Brondizio et al. 2009, Ostrom 2009, Paiva Sobrinho 2014).

The problem to be solved is to minimize the negative impacts of an economic crisis on the population of Mayan descendants in Sodzil. We present the proposal of a complementary currency, the Sodziles, to strength the local economy and social ties among the members of the Mayan community of Sodzil (Campeche, Mexico) that work in a mangrove restoration project. This proposal is under development, and the first conversation with members of the community has already been held. This initiative arises from the field visit of the first and third authors of this article to the study area in partnership with the representatives of the mangrove restoration project.

The mangrove restoration project is important both for the conservation of mangroves and for the social and economic dynamics of Sodzil community. The restoration project is developed by the UAC (Autonomous University of Campeche) and the government of Mexico. This project has contributed to the restoration of hundreds of hectares of mangroves, as well as the social welfare of Mayan people working on the project activities, including channel construction to restore water conditions in the area, as well as reforestation on the edge of those channels with species typical of this ecosystem.

The project started in 2013 and so far contributed to the restoration of 600 hectares of mangrove forest in the Biosphere Reserve Los Petenes, in the Gulf of Mexico, Campeche State. In addition, directly and indirectly, it contributed to the increase in income of dozens of families in the community of Sodzil, see section 2 for details.

Funding for the early years of this project occurred in a period of economic expansion, characterized by the availability of credit granted by both private and government financial institutions, a process typical of the current international monetary system (Paiva Sobrinho, Romeiro, 2016).

Due to its importance, we describe key local environmental, social and economic aspects (section 2), as well as the macroeconomic context within which the project is developing (section 3). This macroeconomic analysis considered especially the credit expansion and level of indebtedness in the various sectors of the country, and especially in Campeche State, where the restoration project is in process. From there, it was possible to identify that Mexico is close to a strong economic recession due to the high level of indebtedness of the sectors of its economy. The occurrence of this crisis may affect government funds to finance the restoration project, as well as economic activities such as construction works on which some of the Mayan descendants depend. There is no economic crisis yet, but it is important to consider the Sodziles as an option in case this crisis happens and also to ensure that the recovered mangroves are protected. Several authors propose the use of complementary currencies for insulating local communities from external crisis (Cato and Suarez, 2012; Ryan-Collins, 2011; Szalay, 2011).

There is a reduced number of complementary currencies (CS) backed by ecosystems and this is the first CS proposal backed by restored mangrove areas. This is a potential contribution to ecosystem conservation alternatives since other initiatives, for example, payment for ecosystem services programs, are highly dependent on the fiat money supply (which tend to be scarce during periods of economic crisis).

## 2. AREA OF STUDY, DESCRIPTION OF THE COMMUNITY AND THE PROJECT AS WELL AS ITS ECOLOGICAL AND SOCIAL OUTCOMES

### 2.1 Study area

The state of Campeche has a population of about 822 thousand inhabitants (0.7% of Mexico's total population) and a population density of 14.3 inhabitants per square kilometer (INEGI, 2011). The state of Campeche also has about 90 thousand people who belong to a group or speak some indigenous language, and of these, about 3 thousand people do not speak Spanish, being the Mayan language the most frequent in the state.

In the area of particular interest of this text is the town of Sodzil, located in one of the only two access routes to the Los Petenes Biosphere Reserve. Sodzil is one of the haciendas that at the end of the nineteenth century and the

beginning of the twentieth were characterized by henequen production, and later, in the second decade of the twentieth century were declining as a consequence of the revolutionary movement, leaving the nearby villages with few local sources of employment and a weak local economy.

The town of Sodzil has an approximate population of 400 people, mostly Mayan population, "ejidatarios" dedicated to subsistence agriculture, beekeeping, or domestic activities; and, above all, construction work in nearby cities such as Campeche and Merida. This situation forces men from Sodzil to spend their working week away from their families and their community, and to invest part of their income in the displacement to these neighboring cities, which limits their investment (both in time and money) destined to improve their living conditions and that of their families.

Additionally to such socio and economic scenario, there are also important environmental indicators that motivated the implementation of the conservation project in the area. In less than a decade, Campeche lost 14% of its mangrove coverage (over 7,000 hectares), mainly due to anthropogenic situations, as oil extraction, rapid urbanization and pollution. Climate change has also played an important role in this degradation.

The mangrove restoration project began in the area in March 2013 with funding from the National Forestry Commission (CONAFOR). The Autonomous University of Campeche (UAC), under direct supervision from the second and fourth authors of this article, carried out the restoration project execution.

Since the project's inception to the present, 600 hectares of mangroves adjacent to Jaina have been restored, in Los Petenes Biosphere Reserve (Figure 1).

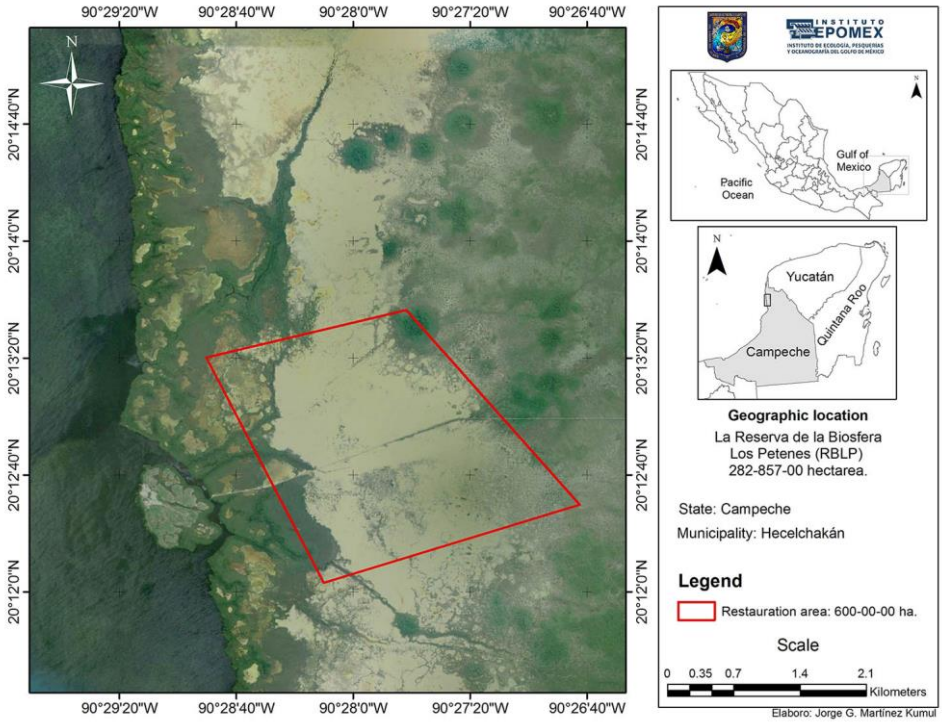


Figure 1. Restoration area located in the Biosphere Reserve Los Petenes, Campeche. Mexico.

The success of the restoration initiative resides in both the restoration strategy described by Agraz Hernández et al. (2016), and the involvement of local people from the Mayan communities of Sodzil, Pomuch, Chunkanan and Hecelchakan. Most workers (direct project partners) belong to the community of Sodzil, which is the one geographically closest to the project site. These people help in the construction and maintenance of channels and the reforestation on its borders.

The restoration was carried out in the study area by building 8 main channels, 69 secondary channels and 17 artificial lagoons (Figure 2 and 3). In addition, with the sediment removed during the excavation of the channels and lagoons cited above, there were built 81 artificial platforms.

Figure 2. Aerial view of the main, secondary artificial canals and artificial lagoons made by the community Sodzil.

The results of the hydrological rehabilitation established significant changes in the hydrological regime resulting from the construction of channels and artificial platforms, as well as the desalination of natural channels (hydrological rehabilitation). Since channels have achieved the increase in amplitude and variability of pore water levels, resulting in decreased water residence times and change in the pore water chemistry conditions.

Figure 3. Construction of the channels through manual excavation Sodzil community.

The built channels contribute to the restoration of mangrove ecosystem as follows:

- Dilute high salinity present in the sediment.
- Increase the diffusion of dissolved oxygen in the water passing between the particles sediment.
- Increase the supply of nutrients to the seagrass.
- Increase the areas of protection, shelter and reproduction of marine species.
- Increase habitats for migratory birds.

Dilution of salinity and increased oxygen diffusion between the particles sediment because of hydrological rehabilitation (digging canals), contributes to increased seedling survival of mangrove species in the field (Agraz Hernandez and Arriaga 2010). They also help to avoid water heating and evaporation along with sediment salinization. Increased fixing of mangrove seedlings helps to increase carbon sequestration in the sediment, contributing to reduced circulation of greenhouse gases in the atmosphere (Nam et al. 2016).

The construction of the channels required a financial investment close to 53333.3 Mexican pesos / hectare, including the maintenance of channels edge and reforestation of 220,000 seedlings of red mangrove (Rhizophora mangle L.) during four years.

### 2.2 Economic and social characteristics

This project has facilitated several social and economic outcomes for the community of Sodzil, including the following:

- Monthly injection of about 400,000 Mexicans pesos in the local economy, through the payment of wages to workers who collaborate with the mangrove restoration as well as additional payments to other community members (mostly women) for the provision of services related to food supply for UAC officials in charge of the project.
- Each worker or laborer receives on average 1200 Mexican pesos per week. The project covers daily transportation costs from the village to the project site and back, increasing the amount of cash available to workers and their families, versus the basic costs of travel to find other sources of employment outside the community.
- Each worker receives the benefit of social insurance which also covers health needs of his family members (wife, children and parents of the worker).
- Laborers work 11 hours daily from 5:00 am to 16:00 pm, Monday to Friday. Of those, six hours are needed for transportation from Sodzil to the restoration area and back Sodzil, plus 6 hours of work. Saturday is a day to devote to activities related to the local economy and culture, as maize cultivation, livestock care, care of beehives, among others. Sunday is paid as a day of rest, based on the labor law.
- By having more time available during the weekend and more free money from his wages (the avoided transportation and accommodation cost to move to other communities to seek work), the project partners spend most of the time available with their families (share time with their children and wives), physical improvement of their homes, working on their land (planting traditional crops for self-consumption) and other work for community improvement such as building the characteristic stone walls of the area and the construction of wells (most of the available water in the area is subterranean).
- Workers express pride as a result of their work in the project and recognize the environmental benefits of the mangrove restoration process that will provide medium and long term positive results.

These project's positive outcomes may be at risk, considering the macroeconomic Mexican context and the current threat of an economic crisis, as described in section 3.

## 3. CURRENT INDICATORS OF THE MEXICAN ECONOMY UNDER THE DOLLAR STANDARD

The dollar standard monetary system is described by Duncan (2005) and Paiva Sobrinho and Romeiro (2016b). In simplified form this system can be characterized by a temporal behavior consisting of several stages: a) rapid expansion of credit by private and / or governmental financial institutions during which the families, business and government debt increases rapidly to levels that make it difficult to pay the interest; b) periods of credit contraction by private financial institutions and / or governments, due to problems related to the high level of debt existing in the main sectors of the (family and business) economy; c) periods when the government increases its borrowing to try to increase the level of economic growth; d) after the deleveraging process of the main economic sectors it can or not observe a new credit expansion phase (Paiva Sobrinho and Romeiro 2016a).

As explained by Paiva Sobrinho and Romeiro (2016a), accelerated credit expansion is related to a context in which some economic sectors are with low debt levels and there is a greater inflow of international financial resources to the country, usually through the current and / or financial account (balance of payments). Part of these resources are invested in the money markets, enabling financial institutions to expand credit allowing greater access to cash to finance long-term loans granted to customers.

Table 1 shows the main components of the balance of payments of Mexico since 2003. It can be seen that, with the exception of 2006, the financial resources that went through the financial account, fueled the current account deficit and contributed to the overall result of the balance (overall balance) is positive.

As explained (Duncan 2005, Paiva Sobrinho and Romeiro 2016a) the positive result of the overall balance implies an increase in Central Bank reserve assets (Figure 4), which, in turn, except when family and business sectors are over indebted, implies an increase in credit expansion by the financial sector (banks, for example) aimed at families, businesses and governments (Figure 5).

Table I. Main Elements of the Balance of Payments of Mexico.

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current Account | -7,2 | -5,3 | -5,1 | -4,8 | -9,0 | -20,3 | -8,3 | -4,9 | -13,2 | -15,9 | -29,7 | -24,0 |
| Financial Account | 18,5 | 14,2 | 16,5 | -2,0 | 22,1 | 32,7 | 16,9 | 47,8 | 53,4 | 53,1 | 66,4 | 58,4 |
| Overall Balance | 9,8 | 4,1 | 7,0 | -1,3 | 10,3 | 8,1 | 4,5 | 20,7 | 28,2 | 17,5 | 17,8 | 16,7 |
| Reserve Assets | -9,8 | -4,1 | -7,0 | 1,3 | -10,3 | -8,1 | -4,5 | -20,7 | -28,2 | -17,5 | -17,8 | -16,7 |
| Net Errors and Omissions | -1,5 | -4,8 | -4,5 | 5,5 | -2,8 | -4,3 | -4,0 | -22,2 | -11,9 | -19,6 | -19,0 | -17,6 |

Source: International Financial Statistics – International Monetary Fund (IMF).

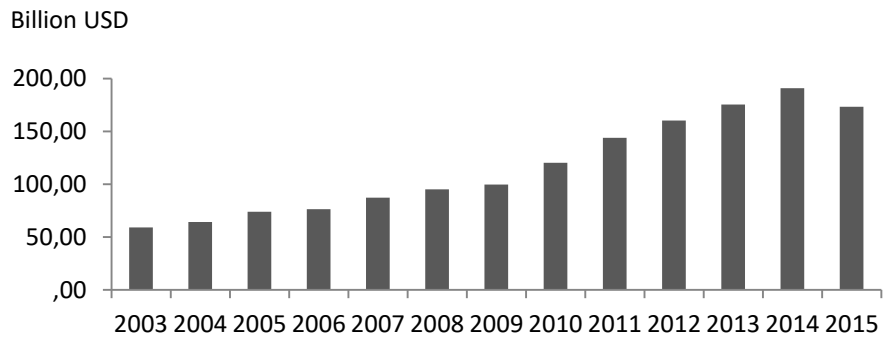


Figure 4. Mexico reserve assets minus gold.

Source: International Financial Statistics – IMF

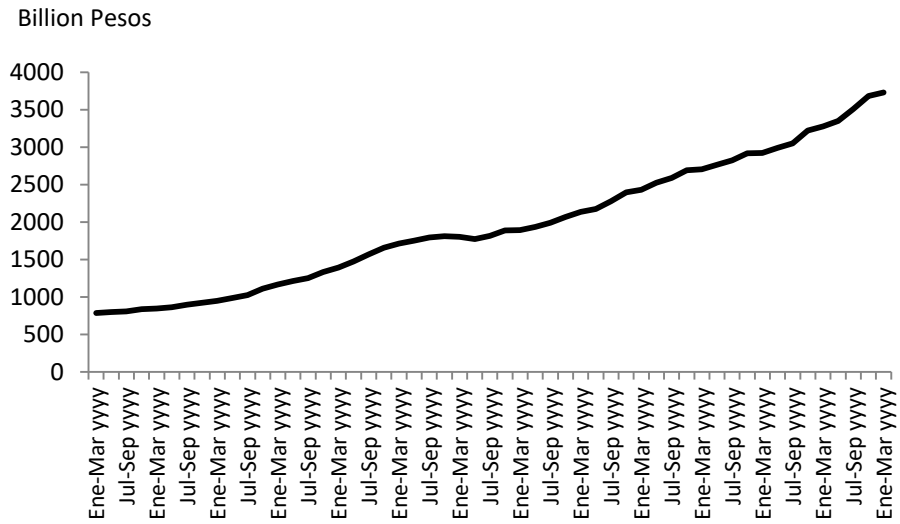


Figure 5. Credit expansion by commercial banks in the economy of Mexico.

Source: Banco de Mexico.

As it can be seen in Figure 4 reserve assets of Mexico, which are composed of international currencies, increased by more than 300% between 2003 and 2014.

Similarly, credit expansion increased by 400%, i.e., most Mexican economic sectors borrowed in excess, increasing their debt levels, as can be seen in figure 6.

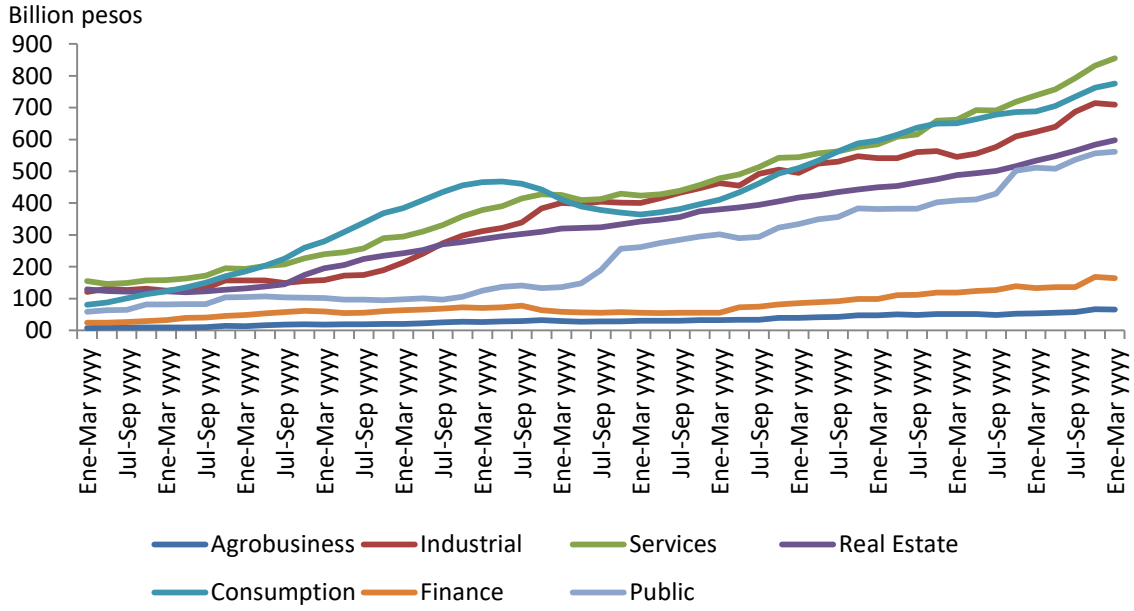


Figure 6. Credit expansion by commercial banks in Mexico by economic sector.

Source: Banco de México.

The following Mexican economic sectors with high debt levels are: public, real estate, industrial, services, consumption (households). According to the Bank of Mexico (2016), the level of debt in the state of Campeche increased by over 1500% between 2003 and 2015 (Figure 7). A similar pattern is seen in other Mexican states (Bank of Mexico, 2016).

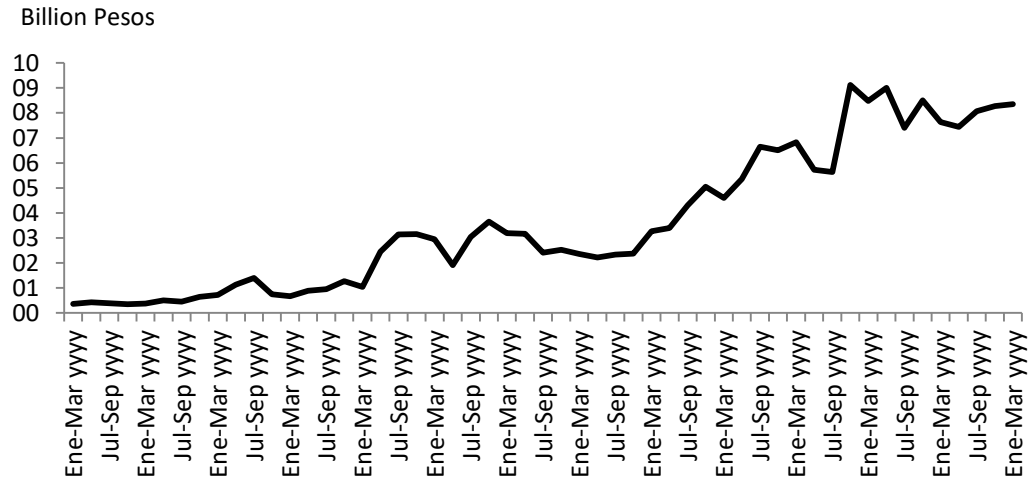


Figure 7. Credit expansion in the state of Campeche.

Source: Banco de México.

The economic crisis that occurred after 1973 (starting point of the dollar standard) show that when sectors of an economy reaches excessive levels of debt, recession is inevitable (Cechetti et al. 2011; Duncan 2005, Koo 2009, 2015, Milne 2009, Reinhart 2009).

The level of severity of the economic recession in Mexico is uncertain and will depend on the response of the central bank, federal government and mainly of the population. The level of indebtedness of the sectors of the economy is high and may reach a point where it is no longer profitable for financial agents that inject funds to the money market. When that time comes, these resources can be directed to other countries where there are still individuals, companies and governments with borrow conditions. That is, other countries that allow short-term financial returns.

### 3.1 The Bright Side of virtual currencies

An economic recession in Mexico could result in higher unemployment in the country, business bankruptcy, tax cuts and to reduce investments in environmental projects, such as the mangrove restoration project. Assuming that this negative scenario happens, it can affect the described project, consequently, Sodzil community could lose jobs in the project, generating lower inflow of financial resources in the local economy, and the loss of the additional social and economic outcomes of the project.

Some people from Sodzil works in agriculture and construction areas in neighboring communities. Since these sectors are highly indebted (Figure 6), the occurrence of that economic recession could generate a reduction in credit for such activities which would result in less job opportunities for people like the residents of the community of Sodzil.

With the economy of Mexico presenting risk of economic recession, a way to minimize the negative consequences that accompany periods of crisis, it is to use the knowledge related to the sustainability of complex flow systems (Ulanowicz et al. 2009, Lietaer et al. 2012).

A complex flow system is a system composed by interconnected nodes where the flow of something occurs. In ecological systems, nodes can be species and the flow can be organic\inorganic materials. In economic systems, nodes can be people, non-financial firms, banks, government institutions, and the flow can be fiat money.

The sustainability of complex flow system depends a tradeoff between resilience and efficiency. Greater the efficiency or resilience less is the sustainability of the complex flow system (Ulanowicz et al. 2009; Lietaer et al. 2012). Inserting complementary currencies increase the resilience of economic system and increase its sustainability (Lietaer et al. 2010).

Even if such scenarios do not occur, it is wise to learn from the lessons of the past and prepare actions that can minimize the negative consequences should they occur. In this sense, the increased resilience of the local economy is critical. Examples around the world show that the inclusion of different types of money in an economy helps to make it more resilient (Stodder and Lietaer 2012).

In this article, we adopt the following definition of money (Paiva Sobrinho and Córdoba Brenes 2016) "Money is an agreement made by a community to accept a standardized item to serve at least as a means of exchange." By "type of money" we mean the way money is created. Since money is an agreement, the community may establish different rules for determining, for example, how people can get the money, how it is created, who can create the money and other similar details.

The definition of money taken in this article is totally different from that proposed (McLeay et al. 2014) "money is a type of IOU (I Owe You)", which serves to maintain the hegemony of existing financial institutions. The type of money that these institutions create, has caused serious economic, social and environmental problems (Lietaer et al. 2012, Paiva Sobrinho and Romeiro 2016).

To avoid local negative consequences of the economic recession looming and increase the resilience of their community, some members of the Mayan community of Sodzil with the support of the technical team of the mangrove restoration project, decided to start the process of delineating a complementary currency, the Sodziles, a type of money backed by mangrove areas recovered, that is described in section 4.

## 4. THE SODZILES: A TYPE OF MONEY BACKED BY MANGROVE AREAS

The mangrove restoration project has contributed to achieve both ecological and social positive outcomes in their area of influence. In order to maintain such benefits even during the occurrence of a financial crisis, the proposal is to create a type of money backed by hectares of recovered mangrove ecosystem, a type of money that will only circulate in the community of Sodzil, taking hence its name: the Sodziles.

Basically, the community should identify needs that are not met and the resources available in the village. The Sodziles serve to connect those needs with the resources that are not being used (example, unemployed people, infrastructure, lands). Therefore, if said connection happens, it is necessary to establish rules regarding the activities that each person can undertake to get Sodziles, and the amount of Sodziles for each activity.

*What purpose could the Sodziles attend?*

The Sodziles could be created in order to promote:

1. Awareness of the mangrove ecosystem importance for the local communities' quality of life.

2. Conservation of mangrove areas restored, even if there is no active project in the area funded by Mexico's government funds.

3. Strengthening the local economy with goods and services exchanges between residents of Sodzil.

4. Positive relationships between neighbors, solidarity and mutual support to improve the common areas of the community.

5. Good environmental practices in homes and crops, such as collection of non-biodegradable waste for recycling and use of natural products for pest control.

### 4.1 Community resilience to economic crisis

The insertion of the Sodziles in the local economy has the potential to enable local handcraft production enterprises, local cuisine, among others local productive activities. In addition, Sodziles can motivate actions and community improvement that could become attractors for tour operators focused on cultural tourism.

*Who administrates the system and how it works?*

The Sodziles would be issued by a group of people in the community who receive training to administer the system. These people, together with the community, shall establish the operating rules of the Sodziles. System rules shall establish at least the following: a) the physical characteristics of Sodziles (paper, plastic or other), b) the exchange rate of the Mexican peso/Sodzil), c) the main function of the new money (medium of exchange and / or store of value), d) which activities are eligible for people to acquire the Sodziles, e) duration of Sodziles (if they possess validity, or not), f) conditions for local businesses to participate in the system in order to use the Sodziles.

The Sodziles can be used into the community of Sodzil, to interchange local products and services between its members. For example, if family A produces fruits and family B needs those fruits, family B can buy the fruits using Sodziles. The family A can now use those earned Sodziles to buy meat from family C or to fully or partially pay for a service provided by neighbor A or B. This way, community members can have the opportunity to save its Mexican pesos for further use (outside the community), allowing the main interchanges inside the community to continue even during national financial crisis, when Mexican pesos availability hits lower levels.

People can acquire Sodziles working in eligible activities, or, receiving donations from other who possess Sodziles.

*The support for Sodziles: restored mangrove areas*

The fact that the Sodziles are backed by restored mangrove areas means that such money will exist only if there are also restored mangrove areas. For example, the administration of Sodziles could establish a correlation between the amount of restored hectares and the amount of Sodziles issued each year: a greater number of hectares restored, will represent a greater amount of Sodziles available to the community.

Currently there are 600 hectares of mangroves restored by the project involving the participation of people from Sodzil. The project started in 2013 and restored, on average, 150 hectares per year. An estimated 53,333.33 Mexican pesos were needed to recover each hectare.

It is important to clarify that the issue of Sodziles should be proportional to the demand of the community and not exceed the total number of hectares of mangrove restored. For example, let's assume that each hectare of restored mangrove equals 10 Sodziles per year.

As there are 600 hectares of mangrove restored, it would have 6000 Sodziles annually. Let us assume that the community needs 3000 Sodziles. In that case, only the necessary amount of Sodziles will be issued. If the community needs 6500 Sodziles, then the administration only issues 6000, corresponding with the maximum area of restored mangroves. Those are some initial ideas on which the community must reflect to implement the system.

The design of a currency backed by restored mangroves is innovative and establishes a different use of the ecosystem. Traditionally, what happens is an exploitation of the biological mangrove resources in order to obtain in return a certain amount of the official country currency (López Hoffman et al. 2006, Sudtongkong and Webb 2008). In the case of Sodziles, the restored mangrove ecosystem becomes the support for the existence of the local currency and serves to address the needs not met by the official currency of the country, in this case the Mexican peso.

## 5. CONCLUSION

As a result of macroeconomic analysis of Mexico it was found that the country is close to an economic crisis because the sectors of its economy have a high level of debt, mainly the sectors of the State of Campeche.

This high level of indebtedness certainly could result in economic crisis, as happened in other countries. To minimize the potential negative effects that such economic crisis might cause in the local Mayan Sodzil economy, the Sodziles are outlined and its initial characteristics presented in the text.

The prototype of the Sodziles describes a type of money backed in areas of restored mangrove ecosystem. To justify the need for this kind of money, mangrove restoration project was analyzed considering ecological, social and economic aspects at different levels.

The Sodziles are still under development. The first conversations between people in the community yielded positive results and demonstrated an open attitude to the proposal.

**BIBLIOGRAPHY**

Agraz Hernández, C.M., and V. Arriaga. 2010. Restauración del manglar en la laguna de Términos. In: Carabias J et al. (coords). Patrimonio natural de México. Cien casos de éxito. México, CONABIO.151-151 p.

Badola, R., and S.A. Hussain. 2005. Valuing ecosystem functions: An empirical study on the storm protection function of Bhitarkanika mangrove ecosystem, India. Environmental Conservation 32: 85–92.

Banco de México. 2016. Estadísticas. http://www.banxico.org.mx/estadisticas.

Brondizio, E.S., E. Ostrom, and O.R. Young. 2009. Connectivity and the governance of multilevel social-ecological systems: the role of social capital. Annual Review of Environment and Resources 34: 253-278.

Cato, M.S.; Suarez, M. 2012. Sproud pound: a local currency to map, measure and strenghthen the local economy. International Journal of Community Currency Research, 16 (D) 106-115.

Cecchetti, S.G.; Mohanty, M., and Zampolli, F. 2011. The real effects of debt. Economic Sysmposium Conference Proceedings, Jackson Hole, pp 145-196.

Duncan, R. 2005. The dollar crisis. Causes, consequences, cures. John Wiley & Sons.

Geels, F.W. 2002. Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy 31 (8/9): 1257–1274.

INEGI. 2011. Panorama sociodemográfico de Campeche, Instituto Nacional de Estadística y Geografía, México. 40 p.

Koo, R.C. 2009. The holy grail of macroeconomics: lessons from Japan's great recession. New York: John Wiley. 356 p.

Koo, R.C. 2015. The escape from balance sheet recession and the QE trap. John Wiley & Sons Singapore. 33 p.

Lietaer, B.; Ulanowicz, R.E.; Goerner, S.J.; McLaren, N. 2010. Is our monetary structure a systemic cause for financial instalibility? Evidence and remedies from nature. Journal of Future Studies.

Lietaer, B., C. Arnsperger, S. Goerner, and S. Brunnhuber. 2012. Money and sustainability: the missing link. Club of Rome report. 216 p.

López Hoffman, L., I.E. Monroe, E. Narváez, M. Martínez Ramos, and D.D. Ackerly. 2006. Sustainability of mangrove harvesting: how do harvesters' perceptions differ from ecological analysis? Ecology and Society 11(2): 14.

Milne, A. 2009. The fall of the house of the credit. Cambridge University Press. 357 p.

McLeay, M. 2014. Money in the modern economy: an introduction. Bank of England, Quarterly Bulletin. http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q1prereleasemoneyintro.pdf

Nam, V.N, S.D. Sasmito, D. Murdiyarso, J. Purbopuspito, and R.A. MacKenzie. 2016. Carbon stocks in artificially and naturally regenerated mangrove ecosystems in the Mekong Delta. Wetlands Ecology and Management 24:231-244.

Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological systems. Science 325: 419-422.

Paiva Sobrinho, R. 2014. Apoio à decisão em sistemas socioecológicos complexos: uma proposta metodológica aplicada na avaliação ex-ante de políticas públicas utilizando moeda complementar. Tese de doutorado, Instituto de Economia, UNICAMP, Campinas, São Paulo, Brasil.

Paiva Sobrinho, R., and K. Córdoba Brenes. 2016. New Money for Sustainability. Sustainability School. 63 p.

Paiva Sobrinho, R., and A. Ribeiro Romero. 2016a. A simple multi-level analytical framework to assess economies under the dollar standard: a step towards solving socioecological problems in the Anthropocene. Instituto de Economía, UNICAMP. 26 p. http://www.eco.unicamp.br/docprod/downarq.php?id=3467&tp=a

Paiva Sobrinho, R., and A. Ribeiro Romero. 2016b. Understanding the dollar standard in order to improve ecological macroeconomic theory. Instituto de Economía, UNICAMP. 20 pp. http://www.eco.unicamp.br/docprod/downarq.php?id=3464&tp=a

Reinhart, C. 2009. This time is different. Princenton University Press, US. 443 p.

Ronnback, P. 1999. The ecological basis for economic value of seafood production supported by mangrove ecosystems. Ecological Economics 29: 235-252.

Ryan-Collins, J. 2011. Building local resilience: the emergence of the UK transition currencies. International Journal of Community Currency Research, 15 (D) 61-67.

Stodder, J., and Lietaer, B. 2012. The macro-stability of Swiss WIR-Bank spending: balance, velocity and leverage. http://ewp.rpi.edu/hartford/~stoddj/WIR_Panel_4.pdf

Sudtongkong, C., and E.L. Webb. 2008. Outcomes of state- vs. community-based mangrove management in southern Thailand. Ecology and Society 13(2): 27.

Szaly, Z.E. 2012. Kekfrank to boost the resilience of locality. International Journal of Community Currency Research, 15 (D) 52-56.

Walters, B.B., P. Rönnbäck, J.M. Kovacs, B. Crona, S.A. Hussain, R. Badola, J.H. Primavera, E. Barbier, and F. Dahduh Guebas. 2008. Ethnobiology, socio-economics and management of mangrove forests: a review. Aquatic Botany 89: 220-236.

Ulanowicz, R.E., S.J. Goerner, and R.G. Lieaer. 2009. Quantifying sustainability: resilience, efficiency and the return of information theory. Ecological Complexity 6(1): 27-36.