



Payments for Ecosystem Services (PES) in Costa Rica

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Preface and acknowledgements

This is my master's thesis that I wrote to finish the master Social and Political Science of the Environment. I have been working on this thesis for a long time and it showed me both highs and lows. Without doubt, only the fantastic moments, especially in Costa Rica, will stay in my memory when I think about my master's thesis. I hope you will read this with joy and interest.

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Summary

The objective of this research is to contribute to a sustainable development of Costa Rica by analysing the possibilities of the implementation of payments for ecosystem services (PES) in the Rio Tempisque Basin. This research investigated the possibility of a successful implementation of PES in the Rio Tempisque Basin by doing a case study in three villages in this region, namely Rosario, Puerto Humo and Pozo de Agua. This objective has been reached by answering the following research question, which can also be seen in chapter 1: What are the opportunities and constraints for payments for ecosystem services (PES) in order to provide a sustainable livelihood for the local communities and conserve the wetlands in the Rio Tempisque Basin?

Wetlands are decreasing by 50% worldwide (Daniels and Cumming, 200). Equally, in the Rio Tempisque Basin in Costa Rica they are decreasing due to two threats: human impact and climate change (see chapter 2). The inhabitants are part of the problem of the decreasing wetlands by means of their most important economic activities, which are cattle and agriculture (Jimenez, Gonzalez and Mateo-Vega, 2001). These require a large amount of water and as a result the human activities are in competition for the water with the wetlands. Besides, climate change reinforces the decreasing wetlands as the temperature will increase to 4°C and precipitation will decrease by 27% in 2080 (Sempris et al., 2008). Additionally, the local communities will not be able to keep their cattle and agriculture, given that there is not enough water to sustain these activities, which will lead to poverty.

Costa Rica started in 1997 with PES, which is a worldwide-recognized system of adding economic value to ecosystems by paying landowners for conserving the ecosystems or for reforestation (Sanchez- Azofeifa et al., 2007). However, chapter 2 shows that PES is not yet implemented in the Rio Tempisque Basin nevertheless, this can be an opportunity for solving the problems in the region.

The institutional rational choice theory and the sustainable livelihood approach, described in chapter 3, were used to answer the research question and to structure this research. The institutional rational choice theory, which is developed by Ostrom, assumes that institutions are necessary to guide individual decisions in the direction that protects the common resources (Ostrom, 2011). The sustainable livelihood approach is a way of analysing and improving the livelihoods of the poor (Serrat, 2008). The two theories are combined in one conceptual model, which shows the relation between the different theories (figure 3.3, p. 25).

The methods that are used to answer the research question are interviews with experts and employees from FONAFIFO and MINAET, questionnaires that have been handed out in Rosario, Puerto Humo and Pozo de Agua and a literature study (chapter 4). The concepts of the conceptual model are operationalized in variables and indicators for the observations and measurements. Besides, to make this operationalization effective in guiding the data gathering, an analytical model (figure 4.2, p. 28) is derived from the conceptual model.

This research report concluded that the implementation of PES in Rosario, Puerto Humo and Pozo de Agua has many opportunities and it is institutionally possible to implement PES in the region. This is elaborated in chapter 5. This chapter shows for example that the rules and laws, local traditions, norms and values allow the implementation of PES. Furthermore, according to the eight principles of Ostrom (1990), PES is potentially a successful institution. However, chapter 5 also shows that PES has two big constraints that cannot ensure a sustainable implementation. First, the payments of PES for the landowners are limited and therefore it cannot ensure a sustainable livelihood. In addition, the people are forced to maintain other forms of income as well, but Costa Rica's main economic activities (cattle and agriculture) cannot instantly be combined with PES as cattle and agriculture result in the overuse of water. Besides, the limited payments will not persuade the local communities to implement PES as the benefits must outweigh the costs. The second constraint is that a sustainable implementation requires the protection of wetlands, where PES only protects forests or realizes reforestation. Although FONAFIFO (the organisation of PES) welcomes the

start of the protection of the wetlands, they do not even have the capacity to comply with the demand for PES for forests. Incorporation of the protection of wetlands goes beyond their present financial capacity.

Chapter 6 of this report summarizes the conclusions that are described above, give a reflection on the theoretical and methodological qualities of this research and makes some practical recommendations. The main recommendation for FONAIFO is to search for more financers to be able to increase the payments for the landowners and to be able to put, besides forest, other ecosystems under protection as well.

Chapter 1 Introduction

1.1 Background of this research

The Rio Tempisque Basin

Costa Rica is a beautiful country in Central America with a great biodiversity. Even though it is a relatively small country, 4% of all the world's biodiversity is represented here (Steinberg, 2001).

The Rio Tempisque Basin in Guanacaste is a region in the northwest of Costa Rica and has several ecosystems: tropical dry forest, riparian forest, mangroves, wetlands and savannah. Despite of the fact that all the ecosystems have their uniqueness, especially wetlands are an interesting ecosystem, because it has unique services; they provide flood protection and carbon storage, ensure the nutrient cycle and the water quality, are an important habitat for many species and are important for hydrological connectivity's (Daniels and Cumming, 2008). The wetlands in Central America have taken over the role of forests to be a habitat for mammals and birds because of deforestation, which make wetlands even more important in the Rio Tempisque Basin (Ellison, 2004).



Figure 1.1 Costa Rica and the Rio Tempisque Basin (see also figure 1.2, p.3) (based on Central Intelligence Agency, n.d.).

However, wetlands are under threat, more so than any other ecosystem and 50% of the wetlands have been lost worldwide (Daniels and Cumming, 2008). Especially the wetlands outside the riverine floodplains are difficult to sustain (Smith et al., 2007). In the Rio Tempisque Basin the wetlands are decreasing as well due to two threats. The first threat is humans, which currently affect the ecosystems. The second is climate change, which affects the area both now and in the future.

People living in the wetland area can be seen as the first threat. The wetlands in the Rio Tempisque Basin require large amounts of water, but the local communities use such an amount of water for purposes such as fresh drinking water, water to produce energy, and water for the cattle and agricultural sectors, that they are in competition for the water with the ecosystems (Daniels and Cumming, 2008). Besides, their wastewater pollutes the wetlands. As a result, there is less water in the area, a dryer landscape and fewer wetlands.

Climate change, the second threat to the area, will cause a rise in temperature of up to 4°C and a decrease in precipitation of 27% in 2080 (Sempris, Anderson, Cherrington, Perez, Flores and

Carillo, 2008). There are many uncertainties about the effects of climate change, but most of the models show large impacts in Costa Rica's ecosystems (Sempris et al., 2008).

These two developments also reinforce each other, since the water shortage that is caused by the inhabitants makes the area dryer and climate change will have a greater impact in areas that are more vulnerable (Jimenez, Gonzalez and Mateo-Vega, 2001).

Developments such as these not only have negative impact on the ecosystems, but more over on the livelihood of the local communities. "A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living" (Krantz, 2001, p.1). Today, most people in the Rio Tempisque Basin work with cattle or in agriculture, but even now this is not enough to provide income for the whole community (Jimenez, Gonzalez and Mateo-Vega, 2001). The unemployment is high and many people have to work in Nicoya (the nearest city). When the area becomes dryer and warmer it will be even harder to get enough water for agriculture and cattle and ensure their livelihood.

In conclusion, the impact of human activities and climate change result in the loss of wetlands, while these wetlands have a high ecological value. Consequently, the existing wetlands need to be conserved and furthermore, the disappeared wetlands need to be restored to ensure the biodiversity in the region. Besides, to ensure the income for the local communities, they must get a sustainable livelihood. 'A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not understanding the natural base' (Chambers and Conway, 1991 in International Recovery Platform, n.d., p.1). With a sustainable livelihood the local communities can stay in the region despite climate change and at the same time conserve the wetlands.

Payments for ecosystem services (PES)

One possible solution for the ecological changes in the Rio Tempisque Basin, and to create a sustainable livelihood, can be payments for ecosystem services (PES). PES is a worldwide-recognized system of giving economic value to ecosystems, by paying landowners for conserving ecosystems or for reforestation (Sanchez- Azofeifa, Pfaff, Robalino and Boomhower, 2007). Given that ecosystems in itself do not have any economic value unless the resources are distributed, it is more attractive for landowners to exploit the resources and the ecosystems than to conserve these. PES supports landowners to conserve their land instead of distributing the resources (Farley, Aquino, Daniels, Moulaert, Lee and Krause, 2010).

Costa Rica has put PES into practice in 1997 and has a specific organization that controls the finances, the National Forest Fund (FONOFIFO) (Quiros, 2003). They are being subsidised by different governments and organisations that benefit of conserving the ecosystems. Despite the wide implementation of PES in Costa Rica, it is not yet implemented in the Rio Tempisque Basin. More about PES and the financiers will be presented in chapter 2.

1.2 Research objective

As a result of the above-mentioned problems and the possible solution of PES the research objective is the following:

The objective of this research is to contribute to a sustainable development of Costa Rica by analysing the possibilities of the implementation of payments for ecosystem services in the Rio Tempisque Basin.

This research objective needs clarification of the different concepts that have been mentioned. Sustainable development is the need to ensure a better quality of life for all, now and in the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems (Agyeman, Bullard and Evans, 2003). This includes people, planet and profit. In this research, and derived from the previous section, people stands for the creation of a sustainable livelihood, planet

stands for the conservation of the wetlands and profit is the economic growth of the households. This will be further elaborated in chapter 2.

This research will give a conclusion about the implementation of PES in the Rio Tempisque Basin in Costa Rica, and will use a case study in three villages: Rosario, Puerto Humo and Pozo de Agua. Nevertheless, the conclusion can also be generalized for equivalent villages in Costa Rica and the world. The three villages: Rosario, Puerto Humo and Pozo de Agua are part of the Rio Tempisque Basin and are situated next to the river Tempisque. The motivation for these three villages is that the inhabitants of these villages have a difficult time in keeping a livelihood since their main economy is cattle and agriculture and this is problematic to sustain as they use so much water, and furthermore, they already notice the impact of climate change (B. Warner, personal communication, 2/02/2011). In fact, they have asked the researcher Ben Warner (see social relevance) to do research on climate change adaptive strategies because they are otherwise forced to move to the city due to all these changes (Warner, 2010). This is why these three villages will be used as case study for this research.



Figure 1.2 Rosario, Puerto Humo and Pozo de Agua in the Rio Tempisque Basin (based on google earth, 26-03-2012).

Another note for this research is the difference between biodiversity and ecosystems. Biodiversity is the variability among living organisms from all sources; this includes diversity within species, between species and of the ecosystems (Mace, Norris and Fitter, 2012). An ecosystem is the interaction between a group of flora and fauna and the abiotic surrounding (Berendsen, 2005). The subject of this research is the conservation of the wetlands as these are the most valuable ecosystem in the research area. Furthermore, this is an important habitat for many species and with the conservation of the ecosystem, the biodiversity will also increase. As these two are closely related, only the ecosystems will be mentioned from now on.

The working of PES will be explained in chapter 2.

Social relevance

Ben Warner is a doctoral student who investigates strategies for a sustainable livelihood in the Rio Tempisque Basin (B. Warner, personal communication, 2/02/2011). One strategy is PES, which will be investigated in this research. The results of this research will be taken into account for his doctoral thesis, so that in the end there is a clear overview of all these different strategies.

Although this research uses a case study in Rosario, Puerto Humo and Pozo de Agua, the conclusions can also be applied to areas in Costa Rica or the rest of the world with the same conditions as these three villages. Besides, the results of this research can be helpful for other countries that are thinking about using PES as climate adaptation strategy.

Ecosystems provide essential services for humans, like wetlands are important for flood protection and protection against storms (Millennium Ecosystem Assessment (MEA), 2005). When these ecosystems disappear, for example because of climate change, these ecosystems can no longer provide these services, and the chances of flooding and erosion will increase. To maintain these essential services of wetlands it is important for the local communities to conserve these wetlands.

Sadly, there is not much research on wetlands and for this reason they get minimal attention from both new managers as policymakers (Ellison, 2004). This makes it even more important to do research on, and focus on, the conservation of the wetlands instead of the other, mostly so favourite, ecosystems, like forests.

Moreover, the water use of local community has a negative impact on their own livelihood. As they are using too much water, it results in water shortage on the longer term so that they cannot keep their cattle and agriculture. However, they need income to be able to stay in the region and PES can be a good alternative.

The essence of conserving the wetlands and the need for the local communities to change their own livelihood make it important to investigate if PES can be a solution. When PES seems to be a good solution, they can stay in the region and implement this programme. If it seems that PES is not possible in this region, they have to look for other ways of a sustainable livelihood.

1.3 Theoretical context

A research can focus on the actors (local communities) or the structure (institutions and resources), which can result in a structure-actor dualism (Andersen and Kaspersen, 2000). The ideal is, though, to use both the actor viewpoint as the structure viewpoint. In fact, the actor and structure interact with each other (Dom, 2005) and institutions structure the social life of communities (Giddens, 1984). The institutional rational choice theory focuses on the institutions, but it stays behind in the focus on the actor side, wherefore the sustainable livelihood approach is used to accentuate the actor side.

The institutional rational choice theory, which is developed by Ostrom, is a theory for protecting resources; in this case, to conserve the wetlands. The sustainable livelihood approach provides a framework to investigate the livelihood of poor people and prescribe where to focus on by investigating livelihoods. Although these two theories have not been combined before, chapter 3 will clarify how these theories can be linked in one conceptual mode.

Institutional rational choice theory

Wetlands are a common good and have to be protected against individual decisions. These individual rational decisions are based on the choice with the most benefits, both financial as social (Ostrom, in Sabatier, 2007). However, this does not have to be the best for the whole community or the common good, as these decisions are mostly self-centred. To protect the wetlands against individual decisions it needs institutions, which make the decision that protects the common good the most attractive so that the people will protect their resources (Ostrom, in Sabatier, 2007). The theory behind this is the institutional rational choice theory and this will be further explained in chapter 3.

The lack of a proper institution in the Rio Tempisque Basin results in that the inhabitants use too much water and that they have a negative impact on the wetlands. PES is an institution that can give the local communities of Rosario, Puerto Humo and Pozo de Agua the right stimulus to protect the wetlands.

Sustainable livelihood approach

The sustainable livelihood approach focuses on the complexity of poverty and helps to overcome this (International Fund for Agricultural Development (IFAD), n.d.). The livelihood of people is the strategy that people develop to survive, like to support their family and make a living (International Recovery Platform, n.d.). It is about their capabilities, assets and activities that people require for their way of life (Serrat, 2008). The sustainable livelihood approach focuses on these assets and

activities and also investigates the political conditions, the natural events around the community and the seasonal conditions to be aware of the external influences on livelihoods (IFAD, n.d.).

Consequently, the institutional rational choice theory and the sustainable livelihood approach are both used in this research and strengthen each other. The institutional rational choice theory investigates how the institutions can help to conserve the wetlands and the sustainable livelihood approach investigates the improvement of the livelihoods of the local community. More about these theories is written in chapter 3.

Scientific relevance

In an article of Vignola, Locatelli, Martinez and Imbach (2009) they suggested PES as a climate adaptation strategy. PES is well developed in Costa Rica and they have a long experience with this programme (Pattanayak, Wunder and Ferraro, 2010). Costa Rica is one of the countries with the longest history in conserving nature and many other countries see Costa Rica as a successful example (Sanchez- Azofeifa et al., 2007 and Zbinden and Lee, 2005). If PES can reduce the effects of climate change, it has to work in Costa Rica. Despite the wide implementation of PES in Costa Rica, it is not yet introduced in the Rio Tempisque Basin. This research can provide new knowledge to literature about PES as climate adaptation strategy.

Developing PES as a climate adaptation strategy is not the only scientific relevance of this research. Another important element is the combination of the institutional rational choice theory and the sustainable livelihood approach as they come from a different field of science. The institutional rational choice theory is used in the social and political science and the sustainable livelihood approach in the development or gender studies. Unfortunately, these two theories are not earlier combined, though nature and people often go together. In development projects, for example, where it is common that the poor people live in the worst circumstances with few resources. Fortunately, this research will combine these two theories. As such, it is a contribution to the development of both these theories by testing the validity of the two theories in new empirical and theoretical conditions.

1.4 Research question

The previous sections mentioned the changes because of human impact and climate change in the Rio Tempisque Basin, which results in a threat for the wetlands and the livelihood of the local communities. PES seems to be a success in Costa Rica and is a possible solution for these changes. This results in the following research question:

What are the opportunities and constraints for payments for ecosystem services in order to provide a sustainable livelihood for the local communities and conserve the wetlands in the Rio Tempisque Basin?

This results in the following sub questions to answer the research question:

1. What are the environmental problems in the Rio Tempisque Basin and why does this require a change of the economy in the area?
2. What is the working of PES and why can this be a possible solution?
3. Which conceptual model can be developed from the interaction between the institutional rational choice theory and the sustainable livelihood approach?
4. What are the institutions and resources in Rosario, Puerto Humo and Pozo de Agua and how can PES be introduced in these?
5. To what extent can PES provide a sustainable livelihood for the local communities in Rosario, Puerto Humo and Pozo de Agua and conserve the wetlands?

The first sub question will result in an overview of the impacts of the local communities and of climate change on the ecosystems, which will clarify why there is a need for change. The second

sub question investigates the functioning of PES and the reason why PES should be introduced in the area. The third sub question will first discuss the two theories and end in a conceptual model. The fourth sub question investigates the existing institutions and resources in Rosario, Puerto Humo and Pozo de Agua and investigates the consequences for the implementation of PES. This sub question will be based on the conceptual model from question 3. The institutional rational choice theory and the sustainable livelihood approach give guidelines related to how these institutions can be investigated and point out the indicators that are important for the protection of a resource and to create a sustainable livelihood. The fifth sub question is the comparison of PES with the criteria of a sustainable development, namely the creation of a sustainable livelihood for the local communities and the conservation of the wetlands. When all these sub questions are answered, the research question will be answered.

1.5 Research model

A research model presents a schematic framework of the research and is based on the method of Verschuren and Doorewaard (2005). This research model is based on the sub questions whereby all the horizontal arrows represent a research question.

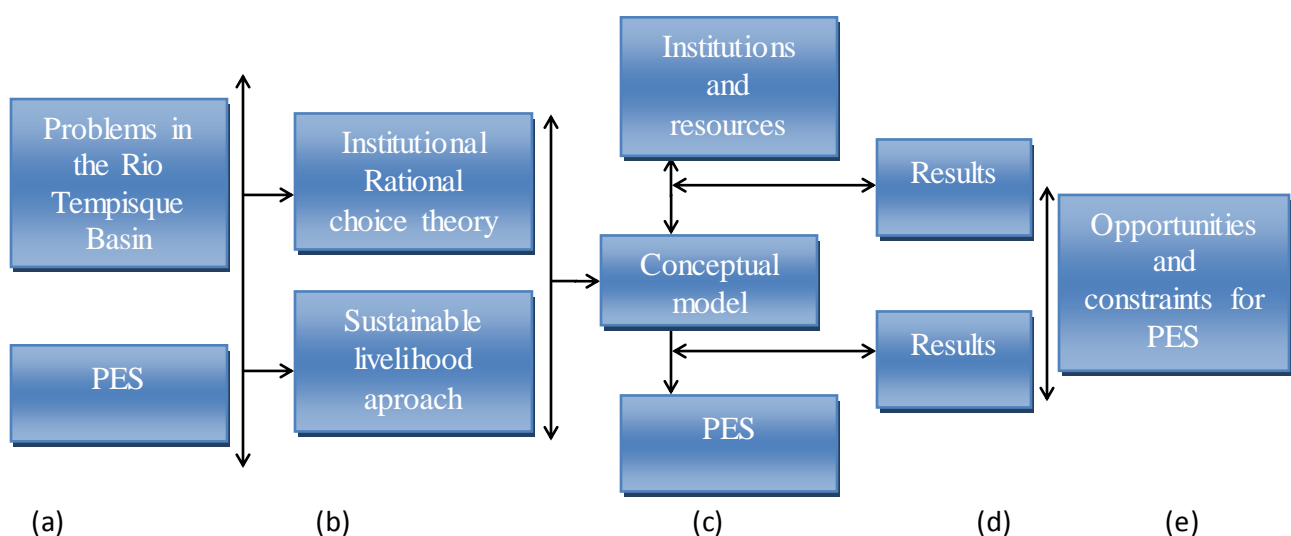


Figure 1.3 Research model.

(a) With the problems in the Rio Tempisque Basin and the possible solution of PES the best theories to use for this research are (b) the institutional rational choice theory and the sustainable livelihood approach, which result in (c) a conceptual model and this shows how the institutions and resources in Rosario, Puerto Humo and Pozo de Agua and PES can be investigated. (d) The results of the observations of the existing institutions and PES will turn out in some results. (e) The comparison of these results will finally end in opportunities and constraints of the implementation of PES.

1.6 Methods

One of the most important elements of a research is the method existing of a strategy and the data sources (Verschuren and Doorewaard, 2005). The strategy used for this research is a case study with a few elements of other strategies. A case study is an in depth research with some observation units or processes, which is done in Rosario, Puerto Humo and Pozo de Agua. This kind of research is generally time-intensive with qualitative data (Verschuren and Doorewaard, 2005).

The research sources are depending on the sub questions. The first two questions are based on a literature study. The rest of the sub questions are based on questionnaires, interviews and a literature study, though this varies per sub question. This division will be discussed in chapter 4. This

triangulation of more than one research method makes that the weakness of one source will be compensated by another source (Vennix, 2006).

For the operationalization of the conceptual model, an analytical model is made, which is the basic assumption of the operationalization.

The motivation for the strategies and materials and the validity and reliability will be discussed in chapter 4.

1.7 Structure of this thesis

This chapter was an introduction of this research about PES in the Rio Tempisque Basin. It is a short introduction about the research problem, the guiding theory and the applied methods. In the following chapters this will be described in more details.

The next chapter, chapter 2, is about the environmental problems in the Rio Tempisque Basin and the relevance of this research. This chapter gives more details about the history of the area, the influence of the local communities, climate change and PES. Chapter 3 contains the institutional rational choice theory and the sustainable livelihoods approach. First, it will describe the general ideas of the theories and second, the theories will be integrated in one conceptual model, which will determine the methods of this research and the approach towards the institutions and the livelihoods. The conceptual model is too complex to structure this research and for this reason an analytical model is created in chapter 4. The methods of this research and the operationalization, influenced by the two theories, are described in the 4th chapter. This also involves the reliability and the validity of this research. Chapter 5 contains the results of the field study and discusses the institutions and resources in Rosario, Puerto Humo and Pozo de Agua and PES. Finally, this will lead to an analysis in terms of the opportunities and constraints of PES. Chapter 6 will be the conclusion of this research with the answer on the research question. In addition, there will be some recommendations for the government of Costa Rica and for further research. The end of this chapter contains a reflection on the quality of the theoretical and methodological aspects of this research.

Chapter 2 The wetlands in the Rio Tempisque Basin, climate change and PES

This chapter presents an overview of the problems in the Rio Tempisque Basin, in particular in the villages of Rosario, Puerto Humo and Pozo de Agua as this will be the object of the case study. It starts with the history of the area and the influence of the local communities in the past and at present. Chapter 1 already introduced this short, though how the inhabitants have affected the wetlands and the livelihoods will be presented here in more detail. It will be interesting to discuss the impacts on the wetlands from the natural science perspective, like the changes of the biodiversity. However, these details will be omitted, because this is a social science research and there will only be short attention for the wetlands and the changes.

The second paragraph, 2.2, is about the impact of climate change. As mentioned before, this is not a research of a natural scientist so this chapter will include the conclusions from literature without the discussions about the causes of climate change and the uncertainties in this field.

Finally, in 2.3, PES will be introduced with a short summary of the history of PES and the reason why the government of Costa Rica decided to implement PES. Furthermore, the organisation of PES will be described, the working of PES and the finances for PES. In the end of this chapter there is a short discussion of the success and failure of PES, which is a discussion in international literature.

2.1 The history of the Rio Tempisque Basin and the human impact

The economic development

The Rio Tempisque Basin has a long history of cultivation and ever since the start of this the main economy of the area has been cattle and agriculture (Jimenez, Gonzalez and Mateo-Vega, 2001). However, the intensity between the two different economies has changed through the years, some periods the cattle industry was most prevalent and in others agriculture.

Beside cattle and agriculture, there was some wood production between 1502 and 1821, but due to limited means of transportation through the river, most of the materials were left to rot away in the fields (Jimenez, Gonzalez and Mateo-Vega, 2001). The National Forest Law states that the forest up until 15 meters from the river must be protected, but these laws are not always adhered to and many trees are cut down (Jimenez, Gonzalez and Mateo-Vega, 2001). Another industry was the fishery, but just like the wood production, this was limited.

In 1970 the production of meat and agricultural products like corn, rice, sugar cane and melon increased for a number of reasons (Jimenez, Gonzalez and Mateo-Vega, 2001). The first reason is the development of the transportation routes. The river Tempisque was the most important transportation route before 1970, but after 1970 a number of routes were built over land, such as the Interamerican highway and some local roads. The second reason was the increasing demand for Costa Rican products from the United States and third the changes in the international markets, which created an increasing demand for beef and sugar and credits from banks made new food developments possible. Nevertheless, these good years were short, and in 1980 the demand for beef and sugar decreased dramatically and, as a result, the production in the Rio Tempisque Basin declined.

What is more, the decline of agriculture has also climatically causes: the precipitation is irregular, the climate variable and the water resources are limited during parts of the year (Jimenez, Gonzalez and Mateo-Vega, 2001). This makes it hard to sustain agriculture in the Rio Tempisque Basin. The declining cattle and agriculture industry makes it for the local inhabitant more difficult to keep an income and many people are forced to move to the city or try to get another job. This makes an alternative income welcome to ensure a livelihood in the Rio Tempisque Basin.



Figure 2.1 Rio Tempisque.

The impact of these human developments on the wetlands

The local environment has been greatly affected by the human economy due to cultivation, deforestation and over-extraction (Jimenez, Gonzalez and Mateo-Vega, 2001). Areas in the Rio Tempisque Basin were cultivated and wetlands and forests were turned into area for their houses, agriculture and pastures land. Deforestation was also caused by the wood production between 1502 and 1821 and has resulted in less biodiversity, more sediment in the water and erosion (Jimenez, Gonzalez and Mateo-Vega, 2001).

Daniels and Cumming (2008) recently concluded that the most important reason for wetland conversion is the distance to the roads and population centre, more than the physical conditions of the area. The more isolated the wetlands are, the more they are conserved. The reason that the wetlands close to humans are threatened, besides cultivation, is over-extraction, change in hydro periods, water runoff and water quality. The communities are growing bigger, but the water use strategy is not accustomed to it (Jimenez, Gonzalez and Matao-Vega, 2001, p. 17). Irrigation for agriculture resulted in over-extraction from water from the river Tempisque. Furthermore, as mentioned in chapter 1, the people are using too much water for fresh water, energy, wastewater, water for the cattle and agriculture (Daniels and Cumming, 2008). At the same time, the infrastructure of the people is structured in a way that the precipitation will get out of the area as soon as possible, which results in less groundwater for the wetlands. This infrastructure protects their houses and roads from floods, but also prevents the water to get into the groundwater so this results in scorching of the ground.

Beside the effects on the water quantity, the water quality is decreasing as well, as the pesticides used in agriculture run into the groundwater and in the river (Jimenez, Gonzalez and Matao-Vega, 2001). This also affects the fish and birds as they consume the pesticides and die from it. Furthermore, the sediments from deforestation degrade the water quality. Plus, Costa Rica does not have a good drainage system, but the water is dropped in the groundwater instead. This water pollution degrades the groundwater and surface water and influences the flora and fauna.

Furthermore, there are also indirect effects on wetlands like climate change (see 2.2), changes in the river upstream and change in wildlife, which altered the biodiversity (Daniels and Cumming, 2008).

All this together has resulted in a decrease of the wetlands in the Rio Tempisque Basin. While the area of wetlands was 32 000 hectares in 1974-1975, the wetlands covered only 7 500 hectares in 2000 (map from Organisation for Tropical Studies, 2011), which is a loss of 77%.

Impact on the livelihoods of the local community

The economic activities did not only affect the ecosystems, but also the livelihoods of the local communities. Agriculture is difficult to sustain because of the decreasing water quantity, so that many people are forced to move to the city and find a new income (Jimenez, Gonzalez and Mateo-Vega, 2001). Also the fishery has a difficult time, because of over-fishing (Jimenez, Gonzalez and Mateo-Vega, 2001).

The river is also a threat for the local communities, because they are not adjusted to it. The river is often flooding during the rainy season because of the intensive rain fall. Many people live near the river, which makes that their houses are often flooded (S. M. Ruiz, personal communication, 02/05/2011). Laws about living by the river are absent and the people are allowed to build houses next to it (Jimenez, Gonzalez and Mateo-Vega, 2001). Although these floods are a threat for the local communities, they provide the wetlands many nutrients and a great amount of water during the floods (Jimenez, Gonzalez and Mateo-Vega, 2001).

Discussing these impacts on the region it is clear that the wetlands as well as the local communities suffer from the impact of the inhabitants in the past and at present. What is more, the local communities are not able to retain their income because of external factors. The decreasing international demand and climatically conditions makes it not profitable to keep their cattle and agriculture.

2.2 The impact of climate change

Climate change is worldwide recognized and causes effects all over the world (Castro, Tattenbach, Gamez and Olson, 2000), equally in Costa Rica. The Rio Tempisque Basin is one of the regions in Costa Rica with an estimated decreasing precipitation of 27% in 2080 (Enquist, 2002). There will also be a temperature rise up to 4°C in 2080, which reinforces the effects of the decreasing precipitation as the rain will evaporate quickly. The country will become more homogenous, because of climate change (Enquist, 2002). The diversity, which is now the beauty of Costa Rica, will disappear and the greatest loss will be in the region diversity. Figure 2.2 and 2.3 present the temperature rise and the precipitation respectively. The baselines in these figures are the average of 1961 and 1990 (Sempris et al., 2008).

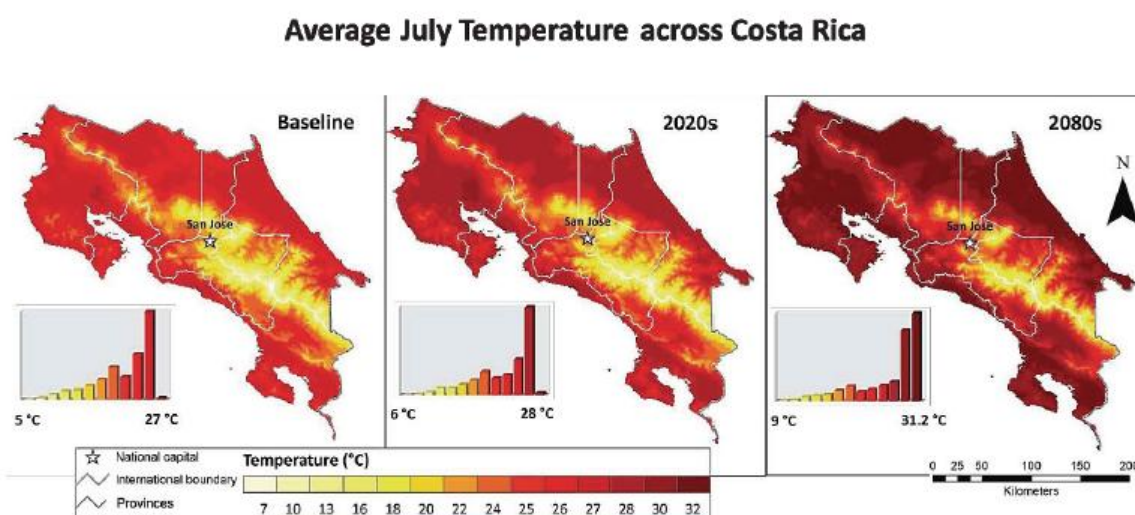


Figure 2.2 Change in temperature (Sempris, Anderson, Cherrington, Perez, Flores and Carillo, 2008).

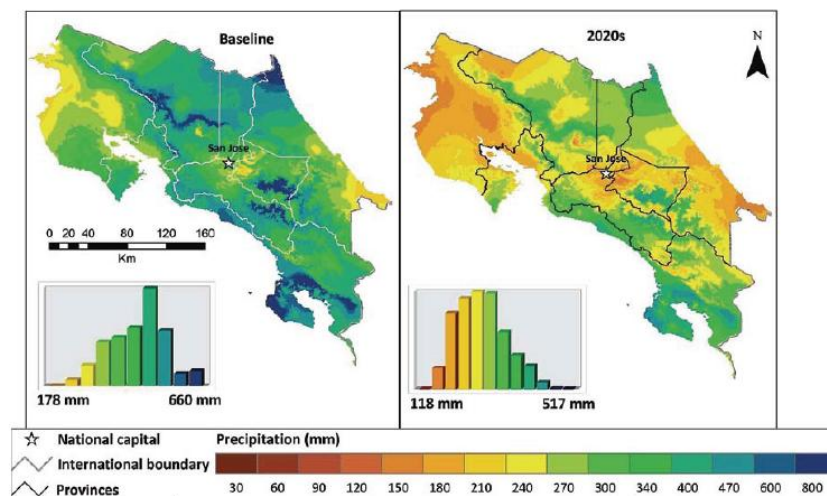


Figure 2.3 Change in precipitation (Sempris, Anderson, Cherrington, Perez, Flores and Carillo, 2008).

Sempris et al. (2008) mention that it would be possible under the worst-case scenario that the ecosystems experience climate stresses in 2020, because of temperature rise and the decrease in precipitation. With less worse scenarios, not many ecosystems will be changed in 2020, but by 2050-2080 the boundaries of the comfort zone will be reached at any scenario (Sempris et al., 2008). This comfort zone are the critical conditions for an ecosystem in which the ecosystem will sustain. Sempris et al. (2008) also emphasized that the protected ecosystems would be less vulnerable than the unprotected areas.

The adaptation of species to climate change means most of the time migration. The species will go to the place with the best conditions and because of climate change these conditions are shifting (Sempris et al., 2008).

On the framework convention on global climate change and the convention on biodiversity, climate change is recognized (Castro et al., 2000). At the same conventions some mechanism are developed to protect the biodiversity and try to minimize climate change. One mentioned strategy is PES, which promotes nature conservation and reduces CO₂ emissions. Besides, at the same time the Kyoto-protocol legalized emissions trading; this made PES possible because countries are allowed to invest in other countries to reach their emission standard. The emission trading gave the developing countries the financial resources to develop PES.

The conclusion of this paragraph is that there will be effects of climate change in the Rio Tempisque Basin, based on the research of Sempris et al. (2008) and Enquist (2002). Although the details of the causes of climate change and the uncertainties are left out, the consequences are clear. Under the best scenario the area will change in 2050 and in the worst scenario already in 2020, but the impacts will be minimal in protected and stable ecosystems. Climate change makes it more urgent to change the livelihood of the local community to reduce the impacts of climate change. Furthermore, the people are forced to change their livelihood to keep an income because the area will become drier over some years and this makes it harder to sustain their cattle and agriculture.

2.3 Payments for ecosystem services (PES)

The history towards PES

The deforestation rate was high in Costa Rica in the 20th century and in 1980 only one fourth of the country consisted of forest (Rodriguez, Toruno, Saenz, Hernendeze and Amighetti, 2005). 50 000 hectares were still disappearing every year for farming, stock raising, legal and illegal logging, burning of fields and ignorance (Rodriguez et al., 2005). This was the reason why the government of Costa Rica decided to take action to conserve the ecosystems.

In 1970 the government developed national parks, which are now the key factor for the big number of tourists. However, this did not solve the deforestation completely and there were no biological corridors to bridge the gaps between the parks (Daniels, Bagstad, Esposito, Moulaert and Rodriguez, 2010). Besides, further expansion of the national parks was not possible because of the growth in population size. To solve the deforestation in the private areas they started with a bonus for reforestation projects in 1979 (Rodriguez et al., 2005). These actions were recorded in the first national forest development plan.

Still, these attempts to stop deforestation were not enough so that the government kept starting with new initiatives. The Ministry of Natural Resources, Energy and Mines (MIRENEM), which had its foundation in 1986, treaded all the forestry initiatives. This ministry turned into the Ministry of Environment and Energy (MINAE) in 1995 and into the Ministry of Environment, Energy and Technology in 2006 (MINAET) (MINAET, 2007). In 1984 the Trust Fund No. 178 was created to conserve the national resources, the forerunner of PES (Rodriguez et al., 2005). The people got funding for reforestation and soil conservation for a period of ten years, financed by the United States. After the Trust Fund the government started with some laws and certificates to promote nature conservation and reduce deforestation. In 1995 a certificate for forest conservation was introduced, the Forest Protection Certificate (Certificado para la Proteccion del Bosque, CPB). This certificate was different from the other certificates because it was not only paid by a government, which was the case by the CPB, but also by the people of Costa Rica (Rodriguez et al., 2005).

The nature conservation was not only an initiative from Costa Rica or a project of the United States, but also other countries had interest. From 1989 till 1995 the first international project was launched when the Netherlands, Sweden and Finland started to finance the Forest Development Fund to promote the conservation of forest, which is in line with emission trading (Rodriguez et al., 2005).

In 1996 MINAE introduced the Forestry Law No. 7575 and in 1998 the Biodiversity Law No. 7788 (Miranda, Porras and Moreno, 2003). One element of the Forestry Law was PES, which came into practise in 1997. The foundation for this programme was the Forest Protection Certificate of 1995 (Rodriguez et al., 2005). The government decided to lay the foundation for an own organisation that could manage PES; the National Forestry Financing Fund (Fondo Nacional de Financiamiento Forestal, FONAFIFO). The global environmental initiatives in the early and mid-1990s, like the Rio Summit and Declaration on the Environment and Development, Agenda 21, the international conventions on climate change, Kyoto protocol, Forestry Principles and the Millennium Goals made Costa Rica decide to implement PES (Rodriguez et al., 2005). These conferences convinced the minister of environment of the advantages of PES (Rodriguez et al., 2005).

The implementation of PES happened in two stages. The first phase was the beginning of the programme from 1997 until 2000 with as main goal to decrease the deforestation rate. In the second phase, from 2001 till now, the programme was more developed. This was the period that FONAFIFO introduced the specific goals of greenhouse gas mitigation, hydrological services, scenic value improvement and biodiversity conservation (Sanchez- Azofeifa et al., 2007). The use of PES is only possible for at least one of the four goals, but these goals do not have to be measured all in one contract. Although all four of the goals are very important, the need for the maintenance of the hydrological services becomes more and more clear, because recent studies concluded that the water resources are limited (Rodriguez et al., 2005).

The working of PES

PES is a programme to pay landowners for the environmental services of their land, which is one of the four goals (greenhouse gas mitigation, hydrological services, scenic value improvement and biodiversity conservation). The programme especially focuses on the small and medium-scale producers (Sanchez- Azofeifa et al., 2007).

There are four kind of contracts under PES; forest conservation, regeneration, reforestation and agro forestry systems (Sanchez- Azofeifa et al., 2007). With all the contracts, the landowner cannot cut the trees and they have to protect the area against fires and damages (J. A. C. Moya,

personal communication, 15/04/2011). It is not allowed to use to area for hunting or grazing and the people have to stop other people from doing it. Another aspect of the contract is to bring awareness to the public by information signs (J. A. Jimenez and A. S. Cardenas, personal communication, 03/05/2011). The only costs they have are for fencing, tree planting and certification (Sanchez-Azofeifa et al., 2007).

The contract for forest conservation requires the conservation of the forest for five years without land cover change (Wunder, 2005).

Regeneration means a natural growth of forest at the same place the forest was destroyed. There are two different contracts, one for the regeneration of pastureland for a period of five years, the pastureland must be deforested at least one year ago, and one contract for regeneration that is determined in the Kyoto Protocol to capture CO₂ (Sanchez-Azofeifa et al., 2007). This contract can be treated under the Clean Development Mechanism (CDM) or another kind of carbon credit. The deforestation must have been occurred before 31 December and the contract is for a period of three years.

The contract for reforestation is for 15 years and the landowner has to plant trees on agricultural or other land. In this contract there is a difference between all kind of trees or only endemic species. The payments are ones in the five years.

With the agricultural systems, trees are planted in agricultural land with a payment for every tree that is planted over a period of three years. Like the reforestation contract, this system has two contracts, one normal and one for only endemic species.

Contract	\$/ ha/ year
Forest conservation	
Protection of forest	64
Protection of water resources	80
Protection of priority zones	75
Protection of forest with custom of the natural fruits	50
Natural regeneration	
Natural regeneration on pasture land, at least one year not in use	41
Reforestation for carbon credits	107
Reforestation	
Reforestation	196
Reforestation, only endemic species	294
Agroforestry systems (for one tree)	
Normal agroforestry systems	1.30
Agroforestry systems, only endemic species	1.95

Table 2.1 Payments for PES (J. A. C. Moya, personal communication, 20/06/2011).

All the programmes have a sustainable background so that the land will keep conserved for some years. The contracts are for three, five years or fifteen years, depending on the forest plantations production cycle of the different species (Rodriguez et al., 2005, p. 18).

The minimum area for PES is three hectares and the maximum 300 hectares, with an exception for land from indigenous people; they can join PES with 1000 hectares (J. A. Cubero Moya, personal communication, 15/04/2011). It is possible for small landowners to start a project and join PES together (Rodriguez et al., 2005). Organisations like the San Carlos Forestry Development Commission (Comision de Desarrollo Forestal de San Carlos, CODEFORSE) and the Central Volcanica Range Development Foundation (Fundacion para el Desarrollo de la Cordillera Volcanica Central, FUNDACOR) can help the people to organise these projects.

Success or failure of PES

It is difficult to measure the success or failure of PES because Costa Rica introduced more instruments beside PES to decrease the deforestation. When the deforestation rate was 59 000 hectares/year in 1980 the deforestation rate was only 4000 hectares/year in 1994 (Rodriguez et al., 2005). This was before the introduction of PES but due to the other laws and projects. In 1998 the government of Costa Rica did a good job as the deforestation rate was decreased to zero. In 1983 the forest cover was only 26.1% and in 1997 it was increased to a forest cover of 40% (Rodriguez et al., 2005). The country could have a forest cover of 70%, which became the goal of FONAFIFO.

In the first phase of the implementation of PES there has been a net increase in forest cover, see the data above (Sanchez- Azofeifa et al., 2007, p.2). However, it is too simple to write this down to PES, for there are also external factors that have influence, like the environmental laws and the monitoring of MINAET en SINAC.

The decreasing deforestation rate is not the only factor to measure the success or failure of the programme. 50% of Costa Rica is forest, where 25% is national park or under another kind of protection. The rest is privately owned and from this 100 000 hectares is involved in PES, which is 8% (J. A. Cubero Moya, personal communication, 15/04/2011). Besides, PES does not only reduce the deforestation in the areas that are under contract but also the areas from people who are not. There are many people who protect their forest so that they can join PES the next year (Rodriguez et al., 2005). PES has given forest a higher value for the landowners (Rodriguez et al., 2005). Instead of to see their land as a useless piece of land or as producer of wood, they can earn something with their forest and get money for the protection of it.

The success of PES depends on how you look at it. However it is not sure if the positive developments are caused by PES, it is sure that the forest cover of Costa Rica is increased and 8% is protected by PES. Besides, it gives ecosystems an economic value, which makes it for landowners more attractive to conserve their land instead of using it for other purposes.

2.4 Conclusion

This chapter draws some general conclusions about the impact of the inhabitants on the region, the possible impacts of climate change and PES as a solution. The first conclusion is that the local communities had in the past and have at present impact on the region, mostly because of cultivation and their cattle and agriculture. The most important impact is the extraction of too much water from the region, which results in decreasing amount of wetlands. Furthermore, climate change will make it harder for wetlands to sustain, because the temperature will rise and the precipitation will decrease. Besides the decreasing wetlands, the local communities have a hard time to keep a sustainable livelihood. They need a sustainable livelihood that will have less impact on the region and that is adaptive to climate change.

PES is a programme to pay landowners for the conservation of ecosystems and this way provide an income for the local communities and conserve the ecosystems of Costa Rica.

This chapter has discussed the first two sub questions: what are the environmental problems in the Rio Tempisque Basin and why does this require a change of the economy in the area? And what is the working of PES and why can this be a possible solution? The next chapter will answer the third sub question: which conceptual model can be developed from the interaction between the institutional rational choice theory and the sustainable livelihood approach?

Chapter 3 Theory

3.1 Introduction

Theories help to order, understand and predict the complex world and at the same time help to construct research (Leroy, Horlings and Arts, 2010). In this research the institutional rational choice theory and the sustainable livelihood approach will be used to give structure. These two theories are introduced in the introduction and will be presented in more detail in this chapter.

Section 3.2 discusses why two theories are used, while most researchers use one theory and it discusses the motivation for these two theories.

Section 3.3 discusses the institutional rational choice theory. This starts with a short introduction of the basic ideas of the theory. Chapter 3.3.1 discusses that institutions are necessary to prevent social dilemmas, which occur with the rational choice theory. Section 3.3.2 focuses on the analysis of the problem and the impact of PES, which is done by the Institutional Analysis and Development (IAD) framework of Ostrom (in Sabatier, 2007). Finally, 3.3.3 looks at the design principles of Ostrom to measure if an institution is suitable to prevent the three social dilemmas.

Section 3.4 deals with the sustainable livelihood approach, which exists of two components: a framework to understand the complexity of poverty and the livelihoods and a set of principles to structure research about poverty (IFAD, n.d.). This framework and principles are discussed in section 3.4.1 and 3.4.2, respectively.

Finally, in 3.5, the two theories will be combined in a conceptual model and this part shows how the theories interact with each other and how the theories will be used in this research.

3.2 The choice for two theories

This research investigates if PES is a suitable institution to create a sustainable livelihood and to conserve the wetlands by investigating the opportunities and constraints of the implementation of PES. Due to the fact that this will lead to a policy change, the use of a policy theory is helpful. The supply of policy theories is diverse as many scholars created theories and expanded existing theories. Sabatier (2007) was able to select and summarize the most important policy theories in the social science. The first theory mentioned by Sabatier (2007) is the institutional rational choice theory, which amplifies why institutions are necessary. Other theories are the multiple streams framework and the punctuated equilibrium. However, these theories focus on how themes arrive at the policy agenda, which is not interesting for this specific research, because nature conservation is already on the policy agenda and now it is important how it can be put into practice. The discourse analysis focuses on the different discourses in a policy process. In this case there is definitely a competition between the different discourses around the same subject, namely which functions the area should have. Yet, the main focus of this research is not on these different discourses, but on finding a solution to overcome this competition between the different discourses. There are more theories discussed by Sabatier (2007) and also by other scholars, though, these will not be discussed here because one theory fits almost perfectly to this research. The institutional rational choice theory is a tool to understand the institutional dynamics to protect the common resources. The wetlands in the Rio Tempisque Basin have to be protected and this cannot be done without institutions.

Before the institutional rational choice theory, the rational choice theory already existed. However, Ostrom (1990) discovered too many limitations of this theory. This theory assumes that communities as a collection of individuals can regulate itself, without institutions or governments. However, this will finally result in the social dilemmas mentioned in 3.2.1. Therefore, Ostrom (1990) developed a new theory to prevent these social dilemmas, namely the institutional rational choice theory.

Although the institutional rational choice theory is a perfect guideline for this research, the theory has one limitation. The institutional rational choice theory focuses much on the institutions with less attention for the actors, which results in a structure-actor dualism (Andersen and Kaspersen, 2000). This dualism means that a research can focus on the viewpoint of the actor (the

acting individuals) or the viewpoint of the structure (the institutions), but the ideal is that both aspects come along. In fact, the actor and structure interact with each other (Dom, 2005) and the institution structure the social life of communities (Giddens, 1984). Without the actor viewpoint, this research does not include the effects of PES on the livelihood of the local communities and this can result in a negative impact for them, while a sustainable livelihood is a goal of this research.

Therefore, another more actor-centred theory is necessary, which can be combined with the institutional rational choice theory. The rational choice theory itself started as an actor oriented theory, but due to the previously mentioned problems, this is not a suitable theory and this is actually in contrast with the institutional rational choice theory. However, the sustainable livelihood approach is a suitable theory to solve the actor-structure dualism, because this theory focuses on the livelihoods and how this can be improved and is totally actor oriented. Hence, this theory will help to investigate the other goal of this research, to create a sustainable livelihood.

A sustainable livelihood is a difficult concept to define, but this is one definition (Chambers and Conway, in International Recovery Platform, n.d., p. 1):

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural base.

The use of these two theories has important benefits as they complete one another's limitations. In literature some limitations of the sustainable livelihood approach come along like inadequate attention to policy and economic processes, power and gender relations and environmental sustainability (Turrall, 2011). The power and gender relations will not be solved in this research, but using the institutional rational choice theory in combination with this sustainable livelihood approach will solve the other two limitations. Positively, the institutional rational choice theory will solve the limitations by focusing on the institutional side of the problem, resulting in a bigger focus on politics. The environmental sustainability is not a direct goal of the institutional rational choice theory; however, it does protect the common resources. In this way the institutional rational choice theory partly fills in this limitation. The sustainable livelihood approach also completes a limitation of the institutional rational choice theory. The institutional rational choice theory only works if the institutions operate bottom-up, which is often a pitfall nowadays as most institutions work top-down (Dietz, Ostrom and Stern, 2003). The community must be involved and traditional tools like communication and visible sanctions must be used to reach a successful outcome. The sustainable livelihood approach ensures that the local communities are participating in the new institution and that the institution work more bottom-up.

Furthermore, Serrat (2008) notices that the sustainable livelihoods approach do not replace other theories, but rather deepens the relationship between the institutions and other external factors with the local communities. This approach makes the research more people-centred, multilevel, dynamic, sustainable and participatory.

Another interesting aspect of the combination of the two theories is the various philosophies. The institutional rational choice theory is a positivistic theory that believes that there is one reality that we can see objectively (Crotty, 2009; Hampsher-Monk and Hindmoor, 2010). The sustainable livelihood approach, however, is a more constructivist theory and they believe that the world is shaped by our thoughts and it has no meaning until we give an interpretation at it, this results in a different interpretation of the world in different cultures (Crotty, 2009). These two philosophies require different methods, positivism is more quantitative and constructivism is more qualitative. Chapter 4 will explain how both methods will be used.

As conclusion, there are many policy theories but the one that fits best to this research is the institutional rational choice theory. However, this theory does not focus on the actor's viewpoint and therefore another theory is necessary, which will be the sustainable livelihood approach. These two theories together help to overcome the structure-actor dualism and they complete each other

limitations. Not all aspects of these theories will be used, but a selection of the concepts is made for this research, which will be represented in 3.4. This paragraph will select and combine the aspects of both theories in one conceptual model.

3.3 Institutional rational choice theory

3.3.1 The institutional rational choice theory

The wetlands are threatened because the local communities use too much water and, in the future, because of climate change. The institutions in the Rio Tempisque Basin appeared to be unable to guide the people in the right direction to protect the ecosystems. The institutional rational choice theory is a theory that focuses on the influence that institutions have on individual decisions to protect resources (Ostrom, 1990), in this case the wetlands.

Institutions are a vague concept and there are different definitions for it. In this research this definition of Ostrom (1990) will be used for institutions. "Institutions are a set of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions" (Ostrom 1986, in Ostrom 1990, p. 51). These institutions can, according to the institutional rational choice theory, protect the common resources.

The institutional rational choice theory is founded on the assumption that individuals make a rational decision, based on costs and benefits (Ostrom, 1990). These costs and benefits can be ethical, for example the protection of the biodiversity, as well as material, for example the financial benefits. This is influenced by people's individual norms and experience and people will choose the option with the most benefits. Ostrom (1990) says that individuals as a group determine the collective action, which in turn identifies the impact of the community on the resources. However, these decisions can only be fully rational when there is perfect information and utility (Ostrom, 2007, p.31). There is often a lack, though, of perfect information and utility, meaning that most decisions are short-term and based on self-interest, and in turn resulting in a negative influence on the resources (Ostrom, 2011). Nevertheless, institutions can provide this information and utility so that individuals can base their decisions on more rational choices and in this way protect the resources.

This research investigates the options of using PES to protect the wetlands in Rosario, Puerto Humo and Pozo de Agua. PES can make it more profitable for the local communities to protect the ecosystems instead of using it for cattle, agriculture or wood. However, PES has to cooperate with the institutions that are already operating in this region. The institutional rational choice theory will help to investigate these possibilities that are further explained in the rest of this chapter.

3.3.1 Social dilemmas of the classical rational choice theory

When there are no institutions, no government and no privatisation, the individual decisions of people can result in social dilemmas, like the tragedy of the commons, the prisoners' dilemma and the free riders problem (Driessen and Leroy, 2007). Section 3.1 shows the pitfall of the classical rational choice theory, namely that these three social dilemmas will occur. Hence, Ostrom developed the institutional rational choice theory and explained the role of institutions to prevent these dilemmas.

The tragedy of the commons arises when all the individuals in a community follow their self-interest instead of the interest of the community, which is the protection of the resources (Ostrom, 1990). For example, in an area one common resource is water that the people need for drinking water, cattle, agriculture, showering, and more. Individuals can profit from using as much water as they want, but this results in water shortage and less water for others in the longer term.

The second social dilemma is the prisoners' dilemma, which arises when people do not work together (Ostrom, 1990). When two people, for example, need fish from the river, each person can catch say a total of two per day. It is most profitable for one person to catch as many fish they can sell, but this would mean that the other person will not be able to catch as many fish as they need. These two people have three options. Option one is that each fisherman catches two fish every day

and they both have the same profit. Option two is that one fisherman catches as many as he can and the other sticks to his total of two fish. The first fisherman will earn more, but the fish level will decrease over the years. Option three is that both fishermen decide to catch as many fish as they can, resulting in short-term profit, but in the longer-term this will lead to over-fishing. Because neither knows what the other will decide, it is best for them to limit themselves to two fish a day.

The third problem, the free riders problem occurs when someone benefits from a resource but does not pay for it while others do (Driessen and Leroy, 2007). Five people may decide to clean the water tap, while someone who refuses to help still gets water from this clean water tap.

How the individuals' react to these problems and in these situations depends on several factors like knowledge, timing, external factors, experience, and norms.

In Rosario, Puerto Homo and Pozo de Agua the first two social dilemmas are especially important: the tragedy of the commons occurs because there is no collaboration to gain more understanding of the water use and the prisoners' dilemma may happen due to a lack of communication. The institutional rational choice theory points out that these dilemmas can be prevented with institutions (Ostrom, 1990). PES will be investigated as a new institution in a complex of existing institutions to prevent the three social dilemmas.

3.3.2 The Institutional Analysis and Development (IAD) framework

The difference between theories and frameworks is important to indicate as they are often confused (Ostrom, 2011). A framework is the most abstract form of the two and presents the concepts and the relations between them (Ostrom, 2011 and Koontz, 2003). A framework helps to generate questions for analysis and can be used by different fields of science. Theories, however, are more specific for one field of science and adjust the framework to specific research questions (Ostrom, 2011). Ostrom has used the Institutional Analysis and Development (IAD) framework and adjusted this to the institutional rational choice theory of the social field. The IAD framework will help to show how common resources can be investigated. The elements of the IAD framework that are the most important for this analysis are presented below.

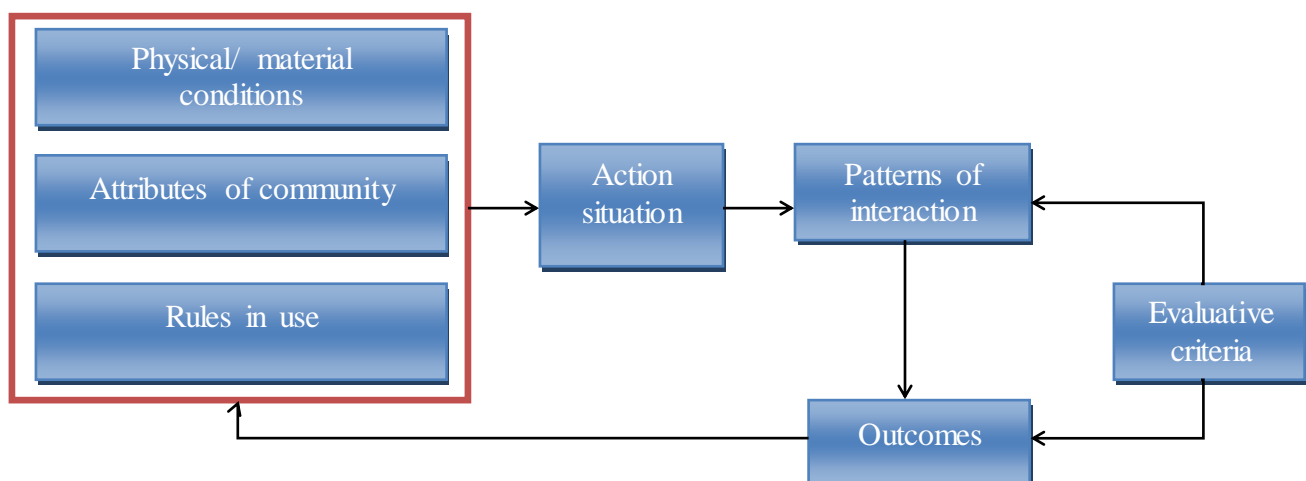


Figure 3.1 Institutional Analysis and Development (IAD) Framework (Ostrom, Gardner and Walker, in Sabatier, 2007, p.27, adjusted to the model of Ostrom, 2011).

The physical and material conditions of the IAD framework are the elements of an area that make something physically possible or impossible (Koontz, 2003, p.4). This includes the kind of ecosystems, whether it is private or public ground, climate and precipitation, size and availability of the common resource et cetera. The attributes of the community include norms of behaviour and common understanding (Koontz, 2003, p.4). These attributes, usually depending on traditions and experience, establish how individuals are expected to act in the community. The rules in use determine what is expected and allowed, what is not and what the sanctions are in particular

situations (Ostrom, Gardner and Walker, 1994). These rules are both written and unwritten, and include all aspects of which actions are expected and required (Ostrom, in Sabatier, 2007, p.36).

There are three levels of rules in use that influence the actions and outcomes: operational rules, collective choice rules and constitutional choice rules (Ostrom, 1990, p. 52). The lowest level of rules are the operational rules that affect the day-to-day decisions and determine the actions of individuals by defining how and when to use the resources, the available information and the sanctions when breaking the rules. The collective choice rules are the management rules and determine who participates. The constitutional choice rules are at the highest level on state level, and determine the collective choice rules. In summary, the operational rules operate at the day-to-day level, the collective choice rules at the management level and the constitutional choice rules at state level. PES operates at a constitutional choice level, which is the highest level of rules.

The action situation is the empirical space where people interact with each other and investigate the structure of the process, the participants of the arena and the position of the actors (Ostrom, 2011). Before 2011, the action situation was called the action arena, which included the action situation and the action actors. However, the boundaries were indefinable and Ostrom renamed it the action situation in 2011.

The action situation consists of the following variables: set of participants, position of individuals, set of actions that are allowed, level of control over their own actions and choices, available information and costs and benefits of the actions and outcomes (Ostrom, Gardner and Walker, 1994, p. 29). The actors can be an individual or a group that takes actions. The participating actors must meet one of the following criteria to be allowed in the action arena: preferences, information, selection criteria or resources (Ostrom, Gardner and Walker, 1994, p. 29). Meeting one of these criteria gives them an interest in the outcomes, which allows them to join the action arena.

The patterns of interaction are the way the participants interact with the institutions and the environment (McGinnis, 2011).

The outcomes are the impacts of the new institution. This research is an ex-ante research and gives a prediction how the existing institutions will change after the implementation of PES.

3.3.3 Eight design principles

Ostrom (1990) discovered in her studies a number of aspects that appeared in every case. These eight aspects have become the design principles for a new institution (Ostrom, 1990, p.90).

1. Clearly defined boundaries of the resources and how the resources can be used in order to make everybody equal and nobody feels kept out.
2. Well-fitting rules adjusted to, among others, time, place, technology and kind of resources.
3. Collective choice arrangements, meaning that the individuals that are affected can participate in developing the operational rules. This gives everyone the opportunity to be involved.
4. Monitoring is necessary to prevent the prisoners' dilemma and free riders problem.
5. Sanctions by the other participants when people break the rules.
6. Quick solutions for conflicts.
7. The government must administer the rules.
8. All these rules must be clear at all the different levels of organization.

These principles help to prevent the social dilemmas and are based on some conditions of the institutional rational choice theory: namely it makes sure that there is clear information and communication, that the conflicts will be solved, improve the compliance, provides a good infrastructure and encourages adaptation (Dietz, Ostrom and Stern, 2003). These conditions are necessary for a good working institution and will prevent the three social dilemmas. The eight principles mentioned above ensure the quality of an institution.

3.3.4 Conclusion of the institutional rational choice theory

The institutional rational choice theory helps to protect the resources with the use of institutions. In addition, these institutions prevent the social dilemmas, the tragedy of the commons, prisoners' dilemma and the free-riders problem. These dilemmas will occur when institutions or another kind of control are absent.

The IAD framework provides a guideline on how institutions can be analysed. With this framework the institutions in Rosario, Puerto Humo and Pozo de Agua will be analysed. Besides, Ostrom (1990) discovered some general principles for institutions to protect the common good. PES will be compared with these principles to examine PES as an institution.

In 3.4 the institutional rational choice theory will be united with the sustainable livelihood approach and linked into one model. Furthermore, there will be some practical questions to clarify the influence of the theory on the sub questions of chapter 1.

3.4 Sustainable livelihood approach

3.4.1 The basic idea of the sustainable livelihood approach

The sustainable livelihood approach is a way of analysing the livelihoods of the poor and how this can be improved (Serrat, 2008). It includes local communities in decision-making and tries to include the livelihoods in developing strategies (Dahlquist et al., 2007). As a result, the approach pays attention to the livelihoods as well as the external elements that influence the livelihoods like the economic, social and institutional factors. It identifies the priorities of the local communities and uses this to improve the livelihoods (Serrat, 2008).

As well as the institutional rational choice theory also the sustainable livelihood approach uses a framework to identify the concepts and relationships between them: the sustainable livelihood framework. This framework contains all the factors that influence the livelihoods of the people. These elements are often forgotten by policymakers but must be taken into account by making new policies (Serrat, 2008). It makes sure that a research is people-centred and contains an actor-centred view.

This framework will help to determine how PES can create a sustainable livelihood. The second step of the sustainable livelihood approach is the guiding principles of the sustainable livelihood approach, which need to be taken into account by doing research about livelihoods.

3.4.2 The sustainable livelihood framework

The sustainable livelihood framework notices people as the most important factor to analyse people's livelihood, influenced by external factors. This is why the livelihoods are placed in the centre of the framework and that they are connected with external factors such as changes and policies and institutional processes. Furthermore, the income level is not the most important factor to measure poverty; for all that the vulnerability, their capability to adapt to changes and their capitals are even important (Farrington, Carney, Ashley and Turton, 1999). This framework tries to take these factors into account when measuring livelihoods and make it more holistic. This is done by identifying five different capacities to measure a livelihood. Figure 3.2 shows the framework, which is not a static model but the different element influences each other and this makes it a dynamic model (IFAD, n.d.).

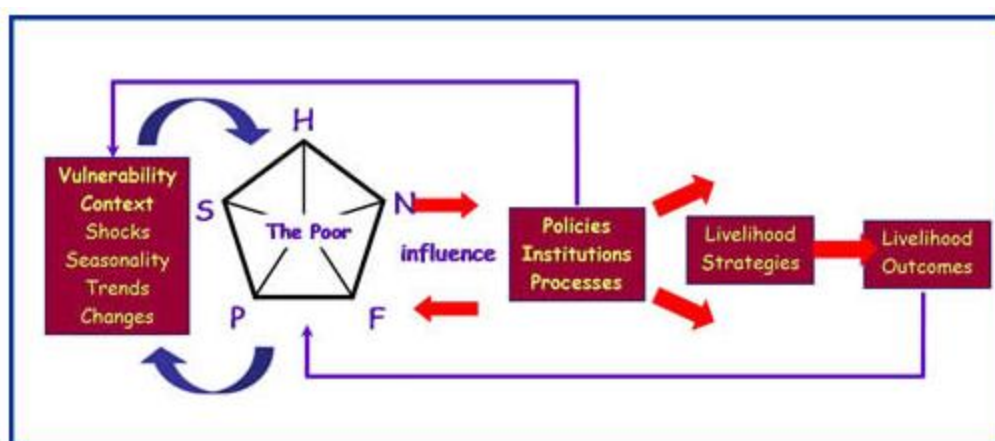


Figure 3.2 The sustainable livelihood framework (IFAD, n.d.).

The centre of this framework presents the capitals: human, social, natural, physical and financial. The first capital of the livelihoods is human capital and this is the individual characteristics like health, education, knowledge, skills, capacity to work and capacity to adapt (Serrat, 2008). The second is social capital and this are the networks, connections, relations of trust and mutual understanding, formal and informal groups, values, rules and sanctions, mechanism for participation and leadership (Serrat, 2008). This is important for the distribution of knowledge and for the cooperation within a local community. The natural capital is the third and this contains land properties, water, trees, forest wildlife, biodiversity and environmental services (Serrat, 2008). People in poor countries rely the most on their natural capital (Cannon, 2011). The fourth capital is physical conditions and contains infrastructure (both of transport as well as to communicate), tools and technology (Serrat, 2008). The fifth and last capital is the financial capital of savings, credit and debt, pensions and salary (Serrat, 2008). Most local communities in livelihood researches have a lack of financial resources, which make the other capitals even more important to compensate this capital (Serrat, 2008).

The vulnerability context is the shocks, seasons, trends and changes, see figure 3.2. The shock events suddenly happen like epidemics, conflicts or natural disasters, which can have big effects without a good health system or knowledge (IFAD, n.d.). The second vulnerability is the season as the seasons determine the prices, production and employment opportunities. The trends are the global trends in the economic, environmental, political, and technology sphere (IFAD, n.d. and Serrat, 2008). The other changes contain all changes of an area and include climate change. As conclusion, the livelihoods are influenced by shocks, seasons, trends and changes, whereby the poor people mostly have a lack of adaptive capacity. The lack of adaptive capacity in combination with these vulnerabilities strongly influences the livelihood of the poor and makes their livelihood insecure. Strong capitals make people able to adapt to these changes, however, the poorest people do not have the capitals for adaptation and this makes them defenceless (Serrat, 2008).

Figure 3.2 also visualises the policies and institutional processes, which influences the livelihood. Serrat (2008) notices that these institutions stimulate people to make better choices; this is elaborated in the institutional rational choice theory. Given that the institutional rational choice theory is clearer about the influence of the institutions, the policies and institutional processes of the sustainable livelihood approach will not be elaborate further.

Like the IAD framework, this framework ends up in the strategies and outcomes of how people interact with their environment. In comparison with the IAD framework, where the main goal was to protect the resources, in this framework the main goal is to improve the livelihoods. Serrat (2008) mentions that these outcomes can be positive for one part of their livelihood, for example their income, but negative for another part, for example their health. Likewise, it can be positive for the livelihoods, but negative for the resources. However, by using both frameworks it will be investigated how PES can be both profitable for the resources as well as for the livelihoods.

As a result, the livelihood of the local communities will be measured according to this framework. The most important factor for the quality of their livelihoods is the capitals. The livelihoods are also depending on the external factors that determine their way of life, like shocks, seasons and trends and the policy and institutional processes.

3.4.3 Guiding principles

The sustainable livelihood approach has some principles to make a research more people-centred. In comparison with the guiding principles of the institutional rational choice theory, these principles do not have to be obtained all in one research, but can be used flexibly and adaptively to different situations (IFAD, n.d.). The principles of the sustainable livelihood approach are developed to structure research and to make a research more people-centred. So these principles have to be taken into account in advance. The guiding principles are (IFAD, n.d., p.1):

1. Be people-centred.
2. Be holistic.
3. Be dynamic.
4. Build on strengths.
5. Promote micro-macro links.
6. Encourage broad partnerships between the public and private sector.
7. Aim for sustainability for a long lasting result.

Although some principles are also treated by the institutional rational choice theory, some principles are an addition for this research. Especially the people-centred principle is an addition, because this is undervalued by the institutional rational choice theory. Furthermore, the seventh principle is an addition to this research, because it makes sure that PES will be used in the long term. Consequently, these principles are used in this research to make this research more people-centred and also to meet the goal of creating a sustainable livelihood, see 3.5.

3.4.4 Conclusion of the sustainable livelihood approach

The institutional rational choice theory is a good theory to analyse how resources can be protected, however, it is equally important to create a sustainable livelihood. After the analysis of the sustainable livelihood approach it is hopefully clear that this theory is a useful theory to overcome this gap.

The sustainable livelihood approach helps to identify the main constraints and opportunities for a sustainable livelihood. With this approach, the livelihoods of the local communities can be investigated and one of the most important elements is that it focuses on the people's capitals and also on the external factors. The external factors influence the capitals, but reversely the capitals also determine whether the people are able to adapt to changes in the external context.

What is more, the sustainable livelihood approach developed some principles for researchers to make a research more people-centred. In contrast with the institutional rational choice theory, these principles are more actor oriented and together with the institutional rational choice theory the actor/ structure dualism can be solved.

In 3.5 the sustainable livelihood approach will be combined with the institutional rational choice theory in a conceptual model and more over it will result in concrete actions for this research.

3.5 Conceptual model

3.5.1 Two theories in one new model

A conceptual model shows the relation between different concepts (Vennix, 2006). In this conceptual model (see image 3.3), the institutional rational choice theory and the sustainable livelihood approach are combined in one model with as starting point the IAD framework and the sustainable

livelihood framework. The different concepts of the two frameworks are added into one model that shows the relation between the frameworks and their concepts.

The concepts of the two frameworks are transformed into new concepts in the conceptual model. The reason for this is that the concepts of the IAD framework are vaguely explained in literature and that the IAD framework is complex (Ostrom, 2011). With these new concepts there is more space for interpretation, which makes it easier to work with it. Furthermore, other concepts make it easier to combine the two theories, as some concepts of one theory and some concepts of the other theory can be put together into one new concept. The new concepts are the institutional, social and natural environment, the action situation, PES and the criteria for a sustainable implementation of PES, which are the creation of a sustainable livelihood and the conservation of the wetlands. In this model, the characteristics of PES are compared with the action situation, which is determined by the institutional, social and natural environment. After this comparison and with the use of two criteria the opportunities and constraints can be analytically extracted.

In the conceptual model some concepts of the two theories are combined and some are left out, since not all the concepts are important for this research. The conceptual model is shown in image 3.3, but first will be clarified how the concepts of the two theories change.

Selection and transformation of the concepts of the IAD framework

The action situation of the IAD framework is established by three concepts: the physical and material conditions, the attributes of the community and the rules in use. These aspects are all important, but the division is changed to make this research more people centred and to connect this research with the sustainable livelihood approach. The physical and material conditions are changed into the natural environment, which are the ecosystems and the changes in the area. The second concept is the attributes of the community and this will be the social environment in the conceptual model. The third concept is the rules in use, which are the official rules and laws and this will be called the institutional environment. These rules determine if and how PES can be introduced within the existing institutions. The division of the social and institutional environment is not theoretically correct as institutions include official rules and laws as well as the norms and traditions of a community. However, in the conceptual model they are separated to put more emphasis on the social aspects and give the social rules and norms a more central role. Besides, with a separate concept for the social aspects, the sustainable livelihood approach is better visible.

The action situation of the IAD framework is not changed in this model, because the boundaries of this concept are clear and it is not in contrast with the sustainable livelihood framework, although not all the indicators will be treated in this research. The first indicator is the set of participants and this depends on who has interest in joining the action situation. The interest depends on the preferences, information, selection criteria and the resources (Ostrom, Gardner and Walker, 1994). The second is the position of the participants. For this research it is only important if people want to implement PES or not. The third indicator is the set of allowed actions and in this research this means the different contracts of FONAFIFO, which are already given in chapter 2. The fourth indicator is the potential outcomes, though this will not be further investigated, because the only strategy that people can choose is PES. The fifth is the level of control, though, this is not significant, because there are no big companies with representatives and the landowners will only speak for themselves and their households. The sixth indicator is the available information and this is important as it determines the balance of power in the action situation. At last, the costs and benefits will be investigated. In conclusion, the set of participants, the position of the participants, the available information and the cost and benefits will be investigated in this research. The potential outcomes and the level of control will be left out.

The patterns of interaction are integrated into the action situation, which contains the interaction of humans with their environment (McGinnis, 2011). The outcomes of the IAD framework are the opportunities and constraints of the conceptual model, this will be explained later in this chapter. The evaluation is a kind of ex ante-evaluation and this will lead to the existing opportunities and constraints.

The principles of the institutional rational choice theory are principles for a good working institution and these principles will evaluate PES as an institution. However, it is not necessary to investigate all the principles since one is already answered in the previous chapter. The seventh principle is that the government must approve the rules, which is done as they lay the foundations for FONAFIFO and some representatives of the ministers are part of FONAFIFO. The rest of the principles will be investigated. Nevertheless, these principles are not visible in the conceptual model but they will be an indicator for PES (see 4.5).

Selection and transformation of the concepts of the sustainable livelihood framework

The sustainable livelihood framework puts the capitals in the centre of the framework and although they cannot be seen in the conceptual model, they are integrated in the institutional, social and natural environment. The human, social and physical capitals are collected under the social environment. These concepts contain elements like health, education, knowledge, trust, relationships and communication. The natural capital is included in the natural environment and this includes, among others, the ecosystems. The last capital is the financial capital and is defined in the social environment and the action situation. The social environment will investigate if the people are financial able to implement PES and the action situation will look for what income the people want to implement PES.

The political and institutional processes are weaved through the whole research and conceptual model, but it can be seen clearest in the institutional environment, which includes the official rules and laws. The livelihood strategy will be PES and the outcomes are the opportunities and constraints. The adaptation to the vulnerability context is a criterion for a sustainable livelihood and the conservation of the ecosystems. The natural environment will look at the effects of climate change and it is also part of the criteria for a sustainable livelihood and the conservation of the ecosystems.

The principles of the sustainable livelihood approach are not integrated into the conceptual model. Thought, they had already influence on this research. To make this research more people centred, which is the first principle, the social environment is investigated as a separate concept instead of a part of the institution environment. To make this research more holistic, it contains many concepts. The use of an actor and a structure-centred theory promotes the micro-macro links, the fifth principle. This strengthens a research and makes the outcomes more grounded in the different levels of a community. Principal six, encourage broad partnerships between public and private sector, is accomplished by PES as the cooperation is between the state and landowners. The seventh principle is sustainability and this is integrated in the whole research and is also a criterion for PES. Only the second principle, be dynamic and the fourth principle, build on strengths, is not taken into account because it will take too much time to investigate the dynamic future of the livelihoods. The principle built on strengths is not a goal of this research itself, nevertheless, it is tried to focus on this with the opportunities.

Conceptual model

All these choices about the IAD framework and the sustainable livelihood framework are adjusted to this research and result in the following conceptual model.

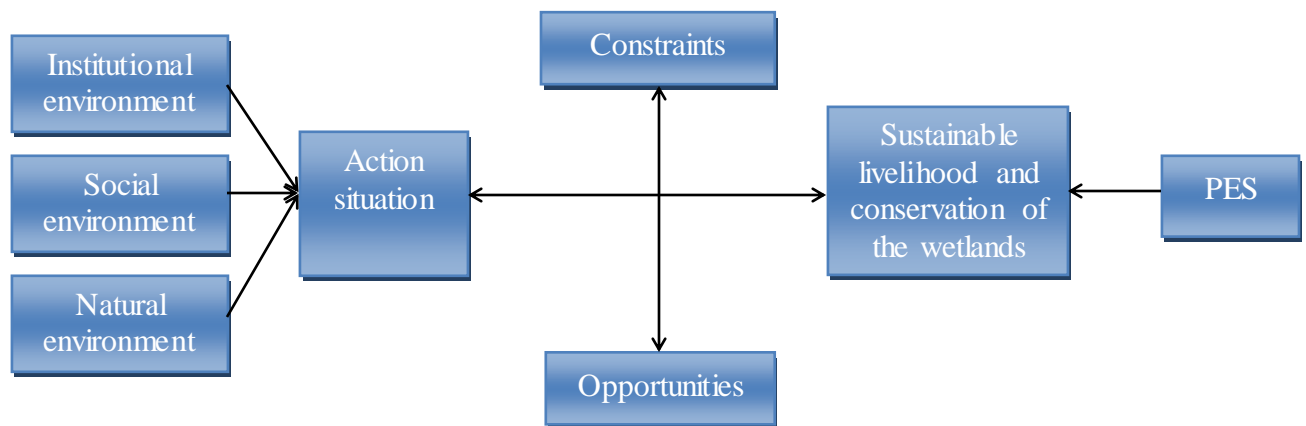


Figure 3.3 Conceptual model.

A conceptual model has two categories: the most important concepts and the relation between these concepts (Verschuren and Doorewaard, 2005). The concepts are the institutional, social and natural environment, the action situation, PES and the sustainable livelihood and the conservation of the wetlands. These concepts are explained above and the relation between the concepts will be discussed here and are shown in image 3.3. The institutional, social and natural environment with the action situation are the concepts to investigate the present institutions and resources. The sustainable livelihood and the conservation of the wetlands are the criteria for a sustainable implementation of PES. The opportunities and constraints from the model are the outcomes. The arrows show the relations between all the concepts.

The first relation is between the institutional, social and natural environments and the action situation. These arrows show that these three environments lead to the action situation, which conclude the existing institutions and resources in Rosario, Puerto Humo and Pozo de Agua.

To see if PES can be introduced in this existing institution, PES will be compared with the action situation (horizontal, two sided arrow). This comparison will lead to a situation where PES is implemented in the current institutions. However, not only does PES have to fit the current institution, its purpose is to be sustainable as well. This is only possible if it creates a sustainable livelihood and if it conserves the wetlands, which are the criteria for a sustainable implementation. Therefore, the comparison of PES with the action situation first 'goes through' these criteria.

When PES can be introduced in the action situation in a sustainable way, this will lead to an opportunity. When PES can be introduced in the action situation but not in a sustainable way, this will lead to a constraint. When PES cannot be implemented in the action situation at all, it will be a constraint. This comparison will have several aspects that determine the opportunities and constraints and when one small detail does not fit this will not immediately results in a constraint but it will be seen with more consideration. The exact criteria for the opportunities and constraints will be discussed in chapter 4.

Describing the opportunities and constraints is the objective of this research. When the opportunities and constraints are clear, an advice can be given on the implementation of PES in the Rio Tempisque Basin.

3.5.2 Elaborated research questions

Chapter 1 presented the sub questions, but these can be elaborated into more guiding questions with the conceptual model in mind. These questions will be answered in chapter 5 and will determine the order of that chapter.

The first three sub questions are already answered in chapter 2 and 3, so these will stay the same.

1. *What are the changes in the Rosario, Puerto Humo and Pozo de Agua and why is this need to change the economy in the area?*

2. *What is the working of PES and why can this be a possible solution?*
3. *Which conceptual model can be found from the interaction between the institutional rational choice theory and the sustainable livelihood approach?*

Sub question 4 is *“what are the institutions in Rosario, Puerto Humo and Pozo de Agua and how can PES be introduced in this?”*. This question in combination with the conceptual model, this can be changes in the following question:

4. *How is the action situation in Rosario, Puerto Humo and Pozo de Agua determined by the institutional, social and natural environment and how does PES meet the principles of Ostrom?*

The fifth sub question is *“how can PES provide a sustainable livelihood for the local communities and conserve the wetlands?”* With the conceptual model in mind, this can be changed in the following question:

5. *In what extent does PES meet the criteria of a sustainable livelihood and the conservation of the wetlands?*

With these questions the conceptual model in integrated and will help to answer the main research question: *“What are the opportunities and constraints for ‘payments for ecosystem services’ in order to provide a sustainable livelihood for the local communities and conserve the wetlands in the Rio Tempisque Basin?”*

3.6 Conclusion

The institutional rational choice theory assumes that individuals need institutions to guide their choice in the right direction. Without these institutions there is a possibility that they have a negative influence on the resources. The IAD framework helps to investigate the existing institutions and also investigates how PES can be introduced in this context. Furthermore, the institutional rational choice theory has eight principles to determine if an institution is able to protect the resources, which will test PES as an institution.

The sustainable livelihood approach is a theory that investigates the opportunities for a better livelihood for poor people. Consequently, this theory helps to investigate the other goal of this research: determine if PES can provide a sustainable livelihood for the local communities in Rosario, Puerto Humo and Pozo de Agua. Like the institutional rational choice theory, this theory has a framework to measure the livelihoods of the local community and measure which external factors have influence on these livelihoods. The sustainable livelihood approach has seven principles to do a people-centred research and these are followed as much as possible.

In the last paragraph the two theories are combined in one conceptual model. The institutional environment, social environment and natural environment determine the action situation. All these together cover the existing institutions and resources. A comparison of PES with this existing institution and with the use of the two criteria; a sustainable livelihood and conservation of the wetlands will clarify the opportunities and constraints for PES.

The new theoretical concepts and the conceptual model give rise to the elaboration of the sub questions of 1.4 and this resulted into new questions. These new sub questions of 4 and 5 will be determined the order of chapter 5, the results and analysis.

The conceptual model of figure 3.3 is the starting point for this research and determines the methods that are used and represented in the next chapter. This chapter will show the methods that are used to answer the research question and furthermore, it will present the operationalization of the different concepts.

Chapter 4 Methods

4.1 Introduction

One of the most important things of a research is the method, which depends on the research object, but also on the available information and sources. Verschuren and Doorewaard (2005) appreciate creativity in the choice for the methods, which is also necessary in this research to combine the two different theories. As it happens, the theories have a different philosophy and these philosophies each use different methods. The institutional rational choice theory is a positivist theory, which requires more quantitative methods, while the sustainable livelihoods approach is a constructivist's theory, and with that uses more qualitative methods. These methods will be combined and are used creatively.

Although this is an individual research, it was created in close cooperation with Saskia Wiegiers, who is doing research for Ben Warner about the possibilities for ecotourism in the same region. Our studies are thus closely related and for this reason the interviews as well as the questionnaires were made and conducted together.

This chapter contains the arguments for all the choices that are made in this research. The methods include a research strategy and data sources. The research strategy is a combination of a case study with some methods of other strategies, see paragraph 4.2. The conceptual model of chapter 3 will lead to an endless research because it does not limit the data gathering and for this reason 4.3 contains an analytical model, which gives structure to this research. There are many available data sources, which makes the source choice important (Verschuren and Doorewaard, 2005). The sources and the reason behind these choices will be discussed in 4.4. In 4.5 the theoretical concepts of chapter 3 will be made operational in measurable variables and indicators. In 4.6 the validity and the reliability will be discussed, which determine the quality of research. The systematic mistakes determine the validity, and the accidental mistakes determine the reliability (Boeije, 2006).

4.2 Research strategy

There are different research strategies depending on whether the research is broad or in-depth, qualitative or quantitative or if it is empirical or desk research. The first choice is between broad or in-depth research. Broad-scope research investigates many aspects while in-depth research investigated specific aspects in more detail. This is an in-depth research to investigate many aspects of PES, the present institutions and the motivation and attitude against PES. Besides, the methods are adjusted to an in-depth research like the interviews. However, also questionnaires were used in this research, which is more for broad-research, but they were qualitative interpreted in a narrative. The second characteristic is that the data qualitative whereas the interviews and questionnaires are presented in a narrative. The last characteristic is that it is an empirical research with only some information from existing literature.

In-depth research with qualitative results and empirical data does not match with one strategy. Yet, Verschuren and Doorewaard (2005) mention that in practice no single strategy is used, but rather combinations of strategies are the most common. This present research used a case study with some aspects of a survey.

The mixed strategies

A case study is a detailed research about one or more cases with qualitative methods (Vennix, 2006). Because it searches for the details of the research objective, it requires time intensive methods, like interviews (Verschuren and Doorewaard, 2005). However, also time extensive methods are used, like the questionnaires, which is a method of the survey. This methods triangulation is at the same time a characteristic of the case study to make a research more valid. This triangulation helps to get a complete image of the case and make a research more holistic.

An advantage of the case study is that the strategy can be changed during the observation and that it needs limited preliminary investigation (Verschuren and Doorewaard, 2005). This was also an advantage in Costa Rica, since the situation in Costa Rica was unclear in advance, which made it harder to prepare the interviews and questionnaires. With the case study it was possible to change the strategy during the research. A disadvantage of the case study is that the results are not generalizable and the results of this research can only be generalizable for cases with the same characteristics.

Another possible strategy, the survey is a research with a large amount of respondents and limited in-depth research (Vennix, 2006). Although this research does use in-depth research, it does also use a large amount of respondents, which is comparable with a survey. This large amount of respondents makes it necessary to use time extensive methods. As this research both use detailed research and many respondents a combination must be found, which is done by using interviews and questionnaires.

4.3 Analytical model

The conceptual model of chapter 3, which is shown again in figure 4.1, will be further developed in an analytical model. The reason for this is that the operationalization of the conceptual model will result in an everlasting research since this model does not structure the data gathering. For example, with the conceptual model, all the variables of the institutional environment must be investigated, which contains the environmental laws, but also criminal law and freedom of speech, while this is not relevant for the implementation of PES. For this reason, this paragraph presents an analytical model that structures this research. The conceptual model is a logical result of the theory however, the analytical model will give more structure to this research, see figure 4.2.

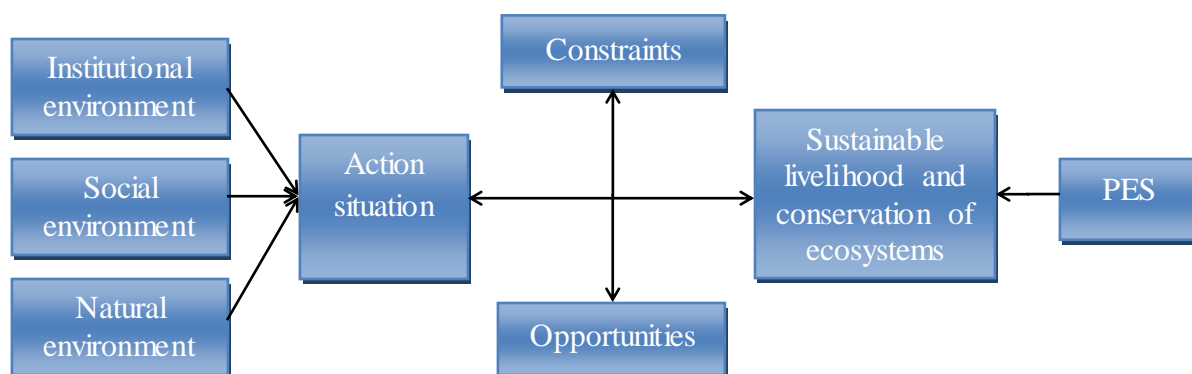


Figure 4.1 Conceptual model.

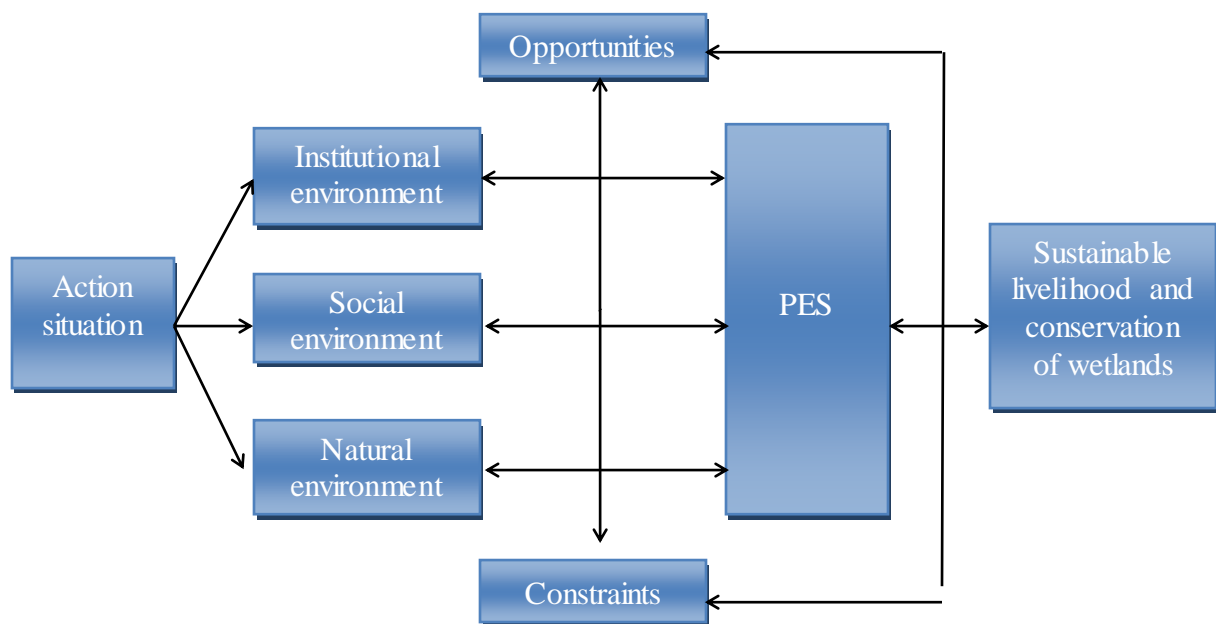


Figure 4.2 Analytical model.

The left side of the analytical model compares the institutional, social and natural environment with PES and this will lead to the opportunities and constraints. In contrast with the conceptual model, this model only investigates the variables of the concepts that are important for the implementation of PES. The action situation is subdivided into the institutional, social and natural environment and the variables of the action situation are also investigated under these environments. 4.5 will present the exact operationalization of the concepts. The relation between the institutional environment and PES will be presented in 5.1, the relation between the social environment and PES will be presented in 5.2 and the relation between the natural environment and PES in 5.3. Finally, the results of the vertical arrow will be presented in 5.6, which are the opportunities and constraints of implementing PES in the present situation, which is resulting from the comparison of PES with the institutional, social and natural environment.

Furthermore, PES is compared with the sustainable livelihood and the conservation of the wetlands to verify the sustainable implementation. In the conceptual model, these two are also presented the other way around, but in the analytical model this is switched to limit the data gathering of the sustainable livelihoods and the conservation of the wetlands so that only the variables that are important for the implementation of PES will be investigated. This operationalization will also be presented in 4.5 and the results of this will be shown in 5.5.

In conclusion, the conceptual model is too theoretical and cannot structure this research and for this reason the conceptual model is restructured in an analytical model that does limit the data gathering. This model limits the data gathering and gives more grip for the operationalization, which will be done in 4.5.

4.4 Data sources

4.4.1 Data sources

There are five data sources for research, namely people, media, real life, documents and literature with all their advantages and disadvantages (Verschuren and Doorewaard, 2005). In this research people, literature and documents are used. The Costa Rican people were an important source and helped to produce much knowledge that was obtained through this study. The main advantages of this source are the people's knowledge, the fact that the information can be produced quickly and that the researcher has a certain degree of control. One disadvantage is that people may not be reliable in sensitive situations; luckily, this was not the case since no sensitive information was required. This study also used documents, although not as many as preferred, since Costa Rica does

not know a broad documentation, like the borders of the communities are not documented. Nevertheless, certain documents were available like the number of inhabitants and maps of the surroundings. Literature was used because of the many pieces of available information on PES, Costa Rica and the livelihoods of the local communities.

Media was not used, because the subject of this research is not reported in the media in Costa Rica. Besides, there are televisions and newspapers, but fewer than in more developed countries. Real life can be observed with an observation schema based on the research question. This observation was not officially used in this research. However, the observation has been important for getting a general feeling of the area and to verify the different kinds of ecosystems. Nevertheless, this is not the official source as the observation is not done with an observation schema guided by theory.

4.4.2 Disclosure of the data sources

The data sources cannot produce new knowledge without adjusting these to the research question. This can be done in different ways with different methods: people gave information through interviews, informal interviews and questionnaires and documents and literature are used with content analysis. Table 4.1 shows the data disclosure. Because the documents and literature are investigated through the same methods, these are shown separate in the table.

	Institutional environment	Social environment	Natural environment	PES	Sustainable livelihood and conservation of the wetlands
Interviews	x	x	x	x	x
Informal interviews	x	x		x	
Questionnaire	x	x	x	x	
Documents			x		
Literature	x			x	x

Table 4.1 Data sources

1. Interviews

People are the main data source in this research by means of face-to-face interviews, written interviews by email and telephone interviews. The face-to-face interviews were the preferable means of contact since these are the easiest to control and more questions can be asked where needed. However, this was not possible with each interviewee, given that some did not want to have a face-to-face interview and preferred an interview by email or through telephone.

The interviews started with a short introduction of our research and the respondent was told which information was expected (Vennix, 2006). The interviews contain standard open-ended questions whereby the interviewer prepares the questions in advance and determines the topics and the order of the topics. Furthermore, with the verbal interviews, the respondents were asked whether the interview could be recorded in order to register the interview afterwards.

One difficult aspect of these interviews is the language barrier. The people in Costa Rica speak Spanish and although the researchers (Saskia Wiegers and Jelleke Bosma) had done a Spanish course, this is not enough to do an interview. Consequently, most of the interviewees were selected on their language (English) or were interviewed with the help of an interpreter. Although the use of an interpreter can sometimes reduce the validity, there was no other option. The validity will be discussed in 4.5.

The interviews were taken in three ways: face-to-face, email and telephone. Saskia Wieggers and Jelleke Bosma did the face-to-face interviews in English and two face-to-face interviews were in Spanish and thereby an interpreter was used to translate it in English. The interviews by email were in English and Spanish and were also done by Saskia Wieggers and Jelleke Bosma. The telephone interviews were in Spanish and were conducted with an interpreter from CEMEDE (the research centre of the Costa Rica National University). The same interpreter was used to ensure the reliability.

To get the needed information, it is important to interview the right people. The choice regarding the interviewees was based on the needed information. The exact list of interviewees is given in appendix 1. The interview questions are discussed in section 4.4. These seven groups of people are interviewed through half open interviews, which included face-to-face interviews, interviews by emails and through the telephone:

1. One researcher from the Organisation for Tropical Studies (OTS), which is a research centre situated in Palo Verde National Park, was interviewed to get more insight in the biodiversity in this area and the attitude of the local communities. This was a face-to-face interview in English.
2. An employee from FONAFIFO gave information about PES, once face-to-face and several times by email, which was always in English.
3. One interview was with an employee from the Costa Rica Tourist Board (ICT) regarding information about the area. Furthermore, this interviewee is an inhabitant of Puerto Humo, which made the interview even more interesting. He provided the opportunity to visit the area and to stay there for a weekend to gain an understanding of the area and the local communities.
4. The fourth group of people is from MINAET, they had much information about the biodiversity and ecosystems in the region and they are also familiar with PES. One interview was face-to-face in English and two interviews were by email in Spanish.
5. A group of researchers from the National University in Nicoya, who do research in Rosario, Puerto Humo, Pozo de Agua and other villages in that area provided information about the biodiversity, land use and many other aspects of that region. They were interviewed face-to-face in English.
6. Two local inhabitants of Puerto Humo were questioned through an interview with an interpreter to get more insight in their belief systems and motivation to do or refuse things.
7. The local authorities of Nicoya were interviewed face-to-face in English and Spanish. This interview was about the destination of the area and about the land uses.

2. Informal interviews

The informal interviews are interviews with people in Rosario, Puerto Humo and Pozo de Agua or other people that are related to this research. These kinds of interviews are, in contrast with the interviews mentioned above, not structured in advance or recorded. They provide a sense about the research area and about the research topics and give more insight into all aspects of this research.

3. Questionnaires

Although it is supposed that questionnaires are the most time extensive kind of source, it was not in this research, since the questionnaires were given to the people in Rosario, Puerto Humo and Pozo de Agua and the researchers waited for the questionnaires to be returned. This procedure is not often used and questionnaires are most often sent by post or conducted over the telephone (Vennix, 2006), but in Costa Rica the post system does not work very well and the telephone numbers are not registered. Another possibility was to hand out the questionnaires and ask for them to be returned a day later, but the researchers in Costa Rica discouraged this topic, as people will often forget it or refuse to fill in the questionnaire. One advantage of receiving the questionnaires back immediately is that if the people do not understand the questions, the researchers are able to explain these. Although, this method is time consuming, it does ensure that all the forms are completed.

The people are selected randomly and the researcher only made sure that all the ages were presented. One difficulty in Rosario, Puerto Humo and Pozo de Agua was that some people are analphabetic, which made it difficult for them to fill in these questionnaires. However, to solve this problem, an interpreter is used and he read the entire questionnaire for the concerning person and filled in their answers.

The questionnaires consist of closed questions to prevent difficult dilemmas according to the language barrier. The questionnaire was translated from English to Spanish by a researcher from CEMEDE in Costa Rica. This way all the alphabetic people were able to finish the questionnaire.

The questionnaires are given to 7,3% of the population (Instituto Nacional de Estadística y Censos (INEC), 2000). Rosario has 206 inhabitants, of whom 12 had filled in a questionnaire; Puerto Humo has 104 inhabitants with 10 respondents and Pozo de Agua 144 inhabitants with 11 respondents. This is 33 from the 454 inhabitants. However, one limitation is that the numbers of the populations are from the year 2000. Sadly, there was no recent data available.

4. Content analysis

Much information is already available in literature and documents and therefore, literature and documents are also used as source, whereby content analysis is used to gather the data. Content analysis is a way to structure literature research, documents and the media (Verschuren and Doorewaard, 2005, p. 136). In advance, the concepts are made operational so that it became clear which data to look for.

The content analysis can be done with quantitative and qualitative information and these will both be used. The quantitative information is used for the success or failure of PES, the inhabitants and the amount of people who join PES. The qualitative information is used to get more understanding about the livelihoods of the people, the existing institutions and the working of PES.

Verschuren and Doorewaard (2005) recommend using systems to find information. Research systems that are used are the library of the Radboud University in Nijmegen, [picarta](http://picarta.com), webofknowledge.com, [scopus](http://scopus.com), [scirus](http://scirus.com) and scholar.google.com. Furthermore, the snowball principle is used, which means that in the literature lists of articles and books is searched for relevant articles and books. Furthermore, some interviewed people gave relevant names of literature or gave it directly. One example of this was a document of FONAFIFO about the working and history of PES.

Documents are also used, although not as many as preferred, since many things in Costa Rica are not documented. Nevertheless, some sources are used about the number of inhabitants and several maps of the Organisation for Tropical Studies (OTS) about the biodiversity, changes of the area and income.

4.5 Operational concepts

Chapter 3 discussed the most important concepts and now these concepts have to be made operational. Concepts are complex and contain many aspects and it is beyond the scope of this study to investigate all the aspects of these concepts, therefore they are made operational. This paragraph makes clear which aspects are important for this research and which variables and indicators are used.

The concepts will be determined through interviews, questionnaires and concept analysis. The variables of the concepts will be explained here and the indicators are presented in appendix 2. The Spanish questionnaire is presented in appendix 3, but the interview guidelines are left out since these differ per interview and can be presented on request. The operationalization is based on the analytical model and table 3.2 presents the indicators for the different concepts.

Concept	Variable	Method
Institutional environment	Official rules and laws	Interview
	Development plan	Interview
	Illegal activities	Interview
	The presence of companies	Interview
	PES in the area	Interview
Social environment	Norms, values and traditions	Questionnaires
	Common understanding	Questionnaires
	Economic situation	Questionnaires and interviews
	Landowners	Questionnaires and interviews
	Participants	Content analysis
	Position and knowledge	Interviews and content analysis
Natural environment	Ecosystems	Interview and content analysis
	Vulnerability	Interview and content analysis
	Patterns of interaction	Questionnaires and interview
PES as an institution	Working of PES	Interview and content analysis
	Financial market	Interview and content analysis
	Ostroms principles	Interview and content analysis
Sustainable implementation of PES	Sustainable livelihood	Interview and content analysis
	Conservation of the wetlands	Interview and content analysis

Table 3.2 Operational scheme

Institutional environment

As mentioned before in chapter 3, institutions contain rules, norms and unwritten rules. However, this research only considers the rules in use for the institutional environment and the norms and unwritten rules are part of the social environment to make the focus of the research more people centred. In this research the institutional environment is determined by the official rules and laws, development plan, illegal activities, the existing companies in the region and if PES is already implemented in Rosario, Puerto Humo or Pozo de Agua.

The introduction of an institution in an existing institution must fit with the rules and laws. PES is on the constitutional choice level, so this result in approval by the government and their laws. The government itself started with FONAFIFO and already approved it. However, it was also investigated if PES can be introduced in accordance with the other level of rules (appendix 2, interview questions 1 and 2, questionnaire I).

Many countries have something like a development plan for the region to determine all the different land uses, the destination of the soil, the economy, et cetera. This development plan gives more insight in the area and the soil destinations and can clarify if PES can be introduced in the region (appendix 2, interview question 3).

It is important for PES to know how the authorities react on illegal activities. The local authorities can help to prevent burning down of forest or hunting in areas that are in contract with FONAFIFO (appendix 2, interview question 4 and 5).

The fourth indicator is the presence of companies in the area. These companies can finance PES if they profit from a good water quantity or quality. This creates more financial security for PES and is already happening in other parts of Costa Rica. Therefore, it is important to determine if there are companies and if they can profit from protecting the water or the wetlands. Nevertheless, the absence of companies will not be a constraint as PES can still be implemented (appendix 2, interview questions 6 and 7).

The last indicator is if PES is already implemented in Rosario, Puerto Humo and Pozo de Agua and this will mean that it is possible to implement PES in the region and furthermore, the inhabitants who join PES can promote it and can help with the implementation (appendix 2, Interview question 8).

The social environment

The social environment is split up in the norms, values and traditions of the local communities, common understanding, the economic situation, costs and benefits, landowners, participants and position and knowledge.

Local communities have their own norms, values and traditions and the new institution must be approved and accepted by this (appendix 2, interview questions 9, 10 and 11, questionnaire II and III.).

According to the institutional rational choice theory the common understanding says something about the relationship between the people in the local communities and the importance of norms and values (Koontz, 2003). Besides, the sustainable livelihood approach emphasizes the common understanding as indicator of trust between the communities and this creates a stronger social capital (Serrat, 2008). Therefore, the common understanding was investigated to investigate the social capital (appendix 2, questionnaire IV.).

The economic situation contains income and determines if it possible to implement PES (appendix 2, interview questions 12, questionnaire V and VI). Income tells something about the present economy and if it is possible to change this income.

It is important for the implementation of PES that the people have their own land to get finance. Therefore the preference is that many people have a small piece of land in order to provide income to all these landowners (appendix 2, interview question 13, 14 and 15, questionnaire IX.).

The participants determine the outcome so all the different participants are taken into account even like their position towards PES and their knowledge (appendix 2, interview question 16, 17 18, 19 and 20, questionnaire X, XI and XII).

The natural environment

The natural environment is split in the ecosystems, the vulnerability context and the patterns of interaction. The ecosystems tell something about the current state of the biodiversity. Furthermore, it says something about the kind of ecosystems, which is important for the different contracts of PES (appendix 2, interview questions 21, 22 and 23).

The vulnerability context contains the changes in the area and other vulnerabilities. The changes are already discussed in chapter 2, however, in the questionnaires and the interviews is determined if climate change is already occurring, if and how the people notice this and if they see a need to change their livelihood because of climate change (appendix 2, interview questions 24, 25, 26 and 27, questionnaires XIII, XIV, XV, XVI and XVII).

The pattern of interaction is the way the people interacts with each other and their environment and if they already protect the environment. This suggests that the local communities are willing to protect the environment even more (appendix 2, interview question 28).

PES as an institution

Besides the comparison of PES with the institutional, social and natural environment and with the sustainability criteria, PES must be evaluated as an institution. The indicators of PES as an institution are the working of PES, the financial market and how PES meets the principles of Ostrom.

The working of PES is already briefly mentioned in chapter 2, though it will be discussed here with another view and more insight from the interviews. This contains how the organisation of PES works and who are involved (appendix 2, interview questions 29 and 30).

The financial market contains the financiers and the stability of the market. To ensure a sustainable implementation of PES the finance in the future must be ensured (appendix 2, interview questions 31 and 32).

At last, PES was compared with the principles of Ostrom (2007): the registration of the boundaries of the properties, the rules adjust to time, place and resources, the monitoring, the sanction on breaking the rules, how FONAFIFO solve conflicts and if the rules are clear through the whole organisation (appendix 2, interview questions 33 till 38). This determines the working of FONAFIFO as institution.

Sustainable implementation of PES

A sustainable implementation of PES requires a sustainable livelihood and the conservation of the wetlands.

The criterion for a sustainable livelihood is the definition by Chambers and Conway (1991 in International Recovery Platform, n.d., p.1): *'A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not understanding the natural base'*. In conclusion, the livelihoods of the local communities are sustainable when they can cope with the vulnerability context both now and in the future. In the Rio Tempisque Basin, climate change is an important vulnerability. A literature study already stated (see chapter 2) that stable ecosystems minimize the effects of climate change, but this will be already investigated with the conservation of the wetlands. Furthermore, income must be ensured in the future for a sustainable livelihood. A sustainable livelihood also contains a good healthcare, education et cetera, however, PES has no influence on these variables, and so only a stable income will be investigated for the sustainable livelihood (appendix 2, Interview question 39 and questionnaire XVIII).

In the Rio Tempisque Basin, the uniqueness of the wetlands is already emphasised in chapter 1 and 2. Therefore, the criterion for the conservation of the wetlands is whether or not the wetlands will be protected in the longer term. It needs an own research to see when these wetlands are able to sustain. For this reason, this criterion is if the wetlands are protected on a longer term and in this way can recover from stress and can be conserved (appendix 2, interview question 40).

Analysis, which lead to the opportunities and constraints

The previous section mentions the variables for the concepts but they also must be compared with each other to see what the opportunities and constraints are for the implementation of PES. After the result section in chapter 5, an analytical section, 5.6, describe the comparison of PES with the institutions and the criteria and this will lead to opportunities or constraints. These conclusions will also be shown in table 5.2.

The comparison of PES with the institutional, social and natural environment has no strict criteria to say if it is an opportunity or a constraint since this differs per variable. With the operationalization of the concepts the most preferable answers are given, for example the implementation of PES must be approved by the official rules and laws. If the present situation does not discourage or even stimulate the implementation of PES, this will be an opportunity. If it prevents the implementation of PES, it will be a constraint. It is also possible that a variable is not an opportunity, nor a constraint, than it will be presented that way and it will not hold the implementation down. Furthermore, when something is a constraint but it can easily be solved, it will still be shown in the option of nor an opportunity nor a constraint. The criterion for a sustainable livelihood is that PES provides a stable income and the criterion for the conservation of the wetlands is that the wetlands must be protected over a longer time period. If PES meets these criteria it will be an opportunity and otherwise it will be a constraint.

The opportunities and constraints will be even important and one constraint will mean that the implementation of PES is not possible or very difficult. Though, this will be a shame for the local communities as they are forced to search for another livelihood strategy. However, the conclusion will also present some recommendations to make the implementation work and for other strategies.

4.6 Validity and the reliability

With the operational concepts in mind, there is a difference between the 'concept as meant' and the 'concepts as investigated' (Vennix, 2006). The theoretical definition of a concept can be different than the concept that the research has investigated. The gap between these two determines the validity of a research. Besides the validity, the concept as investigated can be different than the concept as meant, because of incidental mistakes. This is the reliability and will be discussed in chapter 4.6.2.

4.6.1 Validity

The validity of a research means to what extent the observations are similar as the reality (Vennix, 2006). The data from the observation has to be closely connected with the research question. When the research is about the attitude of people towards the environment and you only ask them their opinion towards garbage, the observation is not connected with the object. So this means that the research is not valid. The validity can be measured about different aspects of a research and in this research the internal and external validity will be discussed. The internal validity determines if the research draw conclusions that fit to the research question and that the researcher measures what he wants to measure (Boeije, 2006). The external validity is the generalisation of a research.

One important aspect of the internal validity is the content validity that measures if the research instrument investigates what you want to investigate. This determines if the 'concept as meant' is the same as the 'concept as investigated'. For the content validity it is necessary to make the concepts operational in advantage, closely related with the theory, and to give feedback on this afterwards. To increase this validity, the questionnaires are first given to some local residents to see if they understood the questions. Furthermore, it is verified if the answers on the questions help to answer the research question. With this feedback the questionnaires are improved to increase the content validity. The same has been done with the interviews: after each interview, the process has been evaluated and the interviews were improved. Furthermore, this validity is attempted to increase by giving the questionnaires to the local researchers, who criticized the questionnaires and with this feedback the questionnaires are improved as well.

The construct validity is also measured, which can be increased if the different concepts show a relation with each other. In the first versions of the questionnaires the concepts did not connect to each other and some answers were even contradictions. This indicated that the people did not understand the questions correctly. Two things were done to make it better understandable for them. First, some questions were changed and second, an interpreter explained the questions if the people did not understand it. Another possibility was to leave out some questions, but this option decreased the validity because it can result in an insignificant amount of questions. This is why changing of the questions and the use of an interpreter was preferred.

As said before, the external validity is the generalisation of the results, which will increase with more observation units. This research draws a conclusion about the three villages in the Rio Tempisque Basin, namely Rosario, Puerto Humo and Pozo de Agua. However, the conclusion of this research is not valid for the whole Rio Tempisque Basin as this is a very diverse region with different circumstances. Nevertheless, the results will be generalizable for the villages in the Rio Tempisque Basin, Costa Rica or even the world with the same characteristics.

As conclusion, the internal validity is high because of the feedback on the questionnaires and the interviews and the relation between the concepts. However, the external validity is not very high because the three villages have the same characteristics and do not say anything about the whole Rio Tempisque Basin. However, the conclusion is indeed valid for villages with the same characteristics.

4.6.2 Reliability

The reliability contains the accidental errors in measurements and furthermore, something is reliable when repeated observations draw the same conclusions (Boeije, 2006). The validity is established by using the sources that measures what you want to measure. When these sources draw the same conclusions every time, the reliability is ensured. However, with a qualitative research, the reliability

is difficult to measure, because the measurements cannot be done for a second time (Vennix, 2006 and Boeije, 2006). Nevertheless, there are still methods to increase the reliability.

A researcher mostly interprets the conclusions subjectively, even though he or she can try to see it objectively. This leads to less reliable results, but when more researchers draw the same conclusions, they are more reliable. Two researchers have done the interviews and questionnaires and came independently to the same conclusions, which makes the conclusion more objective and more reliable.

The reliability also increases with more respondents. In this research 7,3% of the population, 33 from the 454 inhabitants, completed the questionnaires and 11 interviews were done. This is a great amount for a case study.

Another way to increase the reliability is to make use of triangulation, which means that more sources are used to answer the research question. This research has used interviews, questionnaires and content analysis to increase the reliability. The interviews with authorities and researchers are used to get more insight in the institutions and the region, which is verified by a content analysis. The questionnaires give more insight in the belief systems of the people and the informal institutions. To get some more in depth information, two inhabitants of the area are also interviewed. With these different sources, the answers can be verified with the other research sources and this increase the reliability.

Even though the reliability in quantitative research is difficult to establish, it is relatively high. The two researchers draw the same conclusions out of the results, the response is high and triangulation is used to increase the reliability.

4.7 Conclusion

This chapter have discussed the methods of this research. A good research can be done for a second time and must draw the same conclusions, hopefully this chapter explained the methods so carefully that another researcher can follow the footsteps.

Verschuren and Doorewaard (2000) already mention that a research mostly uses a mix of strategies. Although the case study is the clearest in this research, also some other methods are used that can be classified into the survey. Furthermore, this chapter have presented another model as a successor of the conceptual mode, the analytical model. The conceptual model is a logical result of the theory but is however, not suitable to focus empirical measurements. Consequently, the analytical model is presented to structure this research. After the strategy and the analytical model, the sources and methods are presented. These are the interviews, questionnaires and the content analysis. One other important aspect is the operationalization of the theoretical concepts into variables and indicators, which is done in 4.4 and appendix 2. The last part deals with the validity and the reliability to ensure that the research measures what is supposed to measure.

The following chapter presents the results of this research, which is based on these methods.

Chapter 5 Results and analysis

The previous chapter showed the methods that are used for this research and that lead to the results that will be presented in this chapter. The data is gathered in Rosario, Puerto Humo and Pozo de Agua with the use of interviews, questionnaires, documents and literature. The analytical model of figure 4.2 (p. 28) is made to structure this research in a more practical manner. This model showed that the first step is to determine the institutional, social and natural environment, PES and the sustainable livelihood and the conservation of the wetlands. The second step is to compare the institutional, social and natural environment with PES and at last to compare PES with the sustainable livelihood and the conservation of the wetlands.

Paragraph 5.1 describes the institutional environment and this includes official rules and laws, development plan, illegal activities, the existing companies in the region and if PES is already implemented in Rosario, Puerto Humo or Pozo de Agua. Paragraph 5.2 includes the social environment: the norms, values and traditions of the local communities, common understanding, the economic situation, costs and benefits, landowners, participants and position and knowledge. The natural environment, paragraph 5.3, contains the ecosystems, vulnerability context and the patterns of interaction. Paragraph 5.4 describes PES as an institution, which includes the working of PES, the financial market and how PES meets Ostroms principles. The last paragraph, 5.5, presents the criteria for a sustainable implementation, namely a sustainable livelihood and the conservation of the wetlands.

Finally, the results will be analysed in 5.6 and it will be determined if the variables are an opportunity or a constraint. First, the most important conclusions that can be drawn from the results will be repeated. Second, an analysis about these conclusions will lead to the answer whether the variable is an opportunity or a constraint. To give an overview, the opportunities and constraints will be presented in paragraph 5.7 in a table that show the opportunities and constraints.

5.1 PES and the institutional environment

5.1.1 Results

Rules and laws

Chapter 3 stated that PES is operating on the constitutional choice level, which contains the national laws and rules. Since PES is on this level, it is already approved and even founded by the government (Pagiola, 2006). This makes it easier to implement PES. Nevertheless, the constitutional choice rules influence the other levels of rules and PES must also be accepted by these rules levels. According to the local authorities, there are no limitations by the rules or laws on local level to implement PES.

The municipality Nicoya and the management plan

Rosario, Puerto Humo and Pozo de Agua fall under the municipality of Nicoya, however, this city does not have significant influence on the land use in these three villages (S. M. Ruiz, personal communication, 02/05/2011). Given that there is not a kind of development plan (in Dutch bestemmingsplan) that determines the land uses for every piece of land. Instead, the people are allowed to do whatever activity they want on their own land.

On the other hand, the government of Costa Rica started with the introduction of management plans all over the country some years ago (R. R. Quiros, personal communication, 22/07/2011). A NGO called Costa Rica Por Siempre, manages the finance for the plans and different organisations did the implementation, although they had to apply for it. Many organisations, like universities, NGO's and researchers have applied for the management plan of Nicoya, though, only the NGO Costa Rica Por Siempre, MINAET, CEMEDE (research centre) and the communities are involved in the plan (R. R. Quiros, personal communication, 22/07/2011). The communities are represented by one leader of every village and he or she must represent all the different interests. The local communities are also involved by means of education about the management plan and their surroundings, which is organised by the different organisations. In the area around Nicoya, 50

villages and some protected areas are involved; Rosario, Puerto Humo and Pozo de Agua are part of this plan. The protected areas are Barra Honda, Coral de Piedra, Mata Redonda, Palo Verde and Sipanse.

The goal of this management plan is to make a ten years plan to protect the biodiversity, and make guidelines to prevent starting fires and to manage the tourists. Consequently, they try to get more insight in different topics that involve the communities, like land use, inhabitants of the villages and the species in the area, which will be evaluated each year (R. R. Quiros, personal communication, 22/07/2011). One part of the management plan is to determine the boundaries of the protected areas, and furthermore the size of the waters (A. Salinas, personal communication, 01/07/2011). Finance is available to accomplish these activities. This management plan will result in a more controlled economy in the region and less pressure on the ecosystems. Different new economies will be suggested like ecotourism and maybe even PES.



Figure 5.1 Presentation for the local communities about the management plan.

Illegal activities

The implementation of PES requires that illegal activities are prevented. There are some illegal activities in Rosario, Puerto Humo and Pozo de Agua, mostly in the parks nearby, like Palo Verde National Park, and Rancho Humo. In Palo Verde National Park the people like to hunt although this is illegal. For this purpose, the people start fires elsewhere in the park to stimulate all rangers to go over there in order to stop the fires. Meanwhile, the hunters are free to hunt since there are no rangers left to control this (S. M. Ruiz, personal communication, 02/05/2011).

In earlier times, the local people started fires to stimulate the owner of Rancho Humo, which is a wetland reserve, to buy their land. By burning their land, they hoped that the owner of Rancho Humo would buy their land to protect the nature and turn it back into wetland. However, the fires in Palo Verde still happen, the fires next to Rancho Humo do not happen this much anymore.

The presence of companies

The presence of companies in the area can stimulate FONAFIFO to place the local communities of Rosario, Puerto Humo and Pozo de Agua under contract of PES since these companies can finance PES to protect the water quantity or quality. Sadly, at this moment there are no companies in the area that can benefit from the protection of the ecosystems, the water quantity or the water quality (S. M. Ruiz, personal communication, 12/12/2011).

PES in Rosario, Puerto Humo and Pozo de Agua

PES is already implemented with a total area of 247.6 hectares in Puerto Humo and Pozo de Agua. There is a project of 11.5 hectares of reforestation in Pozo de Agua, a project of 31 hectares with forest protection in Puerto Humo and a project of in total 205.1 hectares with natural regeneration in

Puerto Humo (J. A. Jimenez and A. S. Cardenas, personal communication, 03/05/2011). These areas are big so this suggests that this is owned by foreigners. Sadly, it was not possible to come in contact with these landowners.

5.1.2 Conclusions of PES and the institutional environment

Besides that there is no development plan at present and the boundaries are not clarified, the informal interviews with the local authorities and the questionnaires stated that it is politically possible to implement PES in the area. The illegal activities are happening in the area and this must decrease in order to implement PES. Sadly, there are no companies in the area to finance PES. The most important conclusions for the implementation of PES in the institutional environment are:

- The laws and rules approve PES.
- There is no development plan, though a management plan is created.
- Illegal activities are decreasing, although still present.
- There are no companies in the area that can benefit from finance PES.
- PES is already implemented in Puerto Humo and Pozo de Agua.

5.2 PES and the social environment

5.2.1 Results

Norms, values, traditions and common understanding

The local communities indicated that their family was more important than their income, the community or biodiversity when the people have to choose between income, biodiversity, family or community. 61% of the respondents answered family, where biodiversity comes on the last place. The interviews also show evidence that the local people do not care much about the biodiversity since the main concern of them is to survive as several people do not have income at all (S. M. Ruiz, personal communication, 02/05/2011). This means that if the people will implement PES, they will do this to get income and not to protect the biodiversity. This is not because they not care about the biodiversity, it is only because they have a hard time to sustain their livelihood.

PES is not a common livelihood strategy in the Rio Tempisque Basin and it is not part of its traditions. However, the questionnaires indicated that it is also not a struggle with the traditions or norms. Furthermore, the researchers in the area explained that although it is not a tradition, it is possible to start with PES (S. M. Ruiz, personal communication, 02/05/2011 and J. Bravo, 13/05/2011). Even the interviews with the local communities and the informal interviews indicated that PES fit in the existing norms and traditions (J. Matarrita, personal communication, 27/04/2011 and H. Urieta, 15/05/2011).

Common understanding is an indicator for a good relation within the communities and for a strong social capital (Koontz, 2003 and Serrat, 2008). The questionnaires approve that there is common understanding and that the people are interested in each other. Furthermore, the informal interviews showed that there is social cohesion between and within the communities.

Economic situation

Chapter 2 discussed that the economy in the Rio Tempisque Basin has changed in the past, however, this is not only a trend in history, even in recent years the economy is still changing. The main economy was cattle, nevertheless the low prices for livestock made the people change from cattle to corn. Nevertheless, this was also not a stable market, which results in a new economy change, namely milk and cheese or the people moved to cities like Nicoya or San Jose (J. Matarrita, personal communication, 27/04/2011). Pozo de Agua has a special centre for milk collection called Pinky that stimulates the milk market (S. M. Ruiz, personal communication, 02/05/2011). But despite the bad meat market and climate change, the main economy is still cattle and agriculture. This is also the conclusion from the questionnaires. Sadly, beside these economies, there are several local inhabitants who do not have income at all.

Landowners

The implementation of PES is only possible for landowners that have between three hectares and 300 hectares of land. Furthermore, the land has to be private property instead of land from the government. The area in Rosario, Puerto Humo and Pozo de Agua is private property, with exception from Mata Redonda, which is protected. The size of the areas is diverse with many landowners with small pieces of land and some landowners with big areas (N. Rodriguez Garro, personal communication, 07/05/2011).

The questionnaires also investigated how the work of the local communities is organised and this gave various answers. The most people are chief with employees, employee or unemployed, nevertheless, also four people were chief without employee. It is important for the implementation of PES that the people have their own piece of land to get finance from FONAFIFO. As stated in the previous paragraph the most people of Rosario, Puerto Humo and Pozo de Agua have a small piece of land. Though, if they want to implement PES, they have to be organised. The half of the people stated that they are not able to implement PES, which suggests that are not a landowner, but it is also possible that the people do not have the knowledge to implement PES.

In contrast, the people pointed out that they are financially able to implement PES. However, they also indicated that they only want to implement PES if they get more finance for PES than they have at present. This is because mostly because the people have minimal income or no income at all (S. M. Ruiz, personal communication, 02/05/2011).

The threat in Costa Rica is that the landowners with small pieces of land burn their land in order to sell it to foreigners. These foreigners buy this land that is burned down and start with extensive productions of pineapple or other agricultural products (J. Bravo, personal communication, 13/05/2011). These productions use a large amount of water and this makes the area drier. The landowners who sold their land move to cities like Nicoya and San Jose. PES, however, can give the landowners the opportunity to keep their land and stay in the region.

Participants and their position

Several actors are participating for the implementation of PES in the existing institutions. The first actor is FONAFIFO, which is the organisation of PES and they regulate all the financial streams. The government of Costa Rica laid the foundation for FONAFIFO and is furthermore an important financier. The financiers for PES are also participants, however, they will not affect the implementation of PES in the Rio Tempisque Basin as the location of PES will not influence the decision of financiers to invest in PES or not. Their interest is the investment through the whole country. Therefore, the position of these financiers will not be discussed. The landowners are the most important participant for this research as they have to implement PES, whereby the NGO's can help to organise the small landowners. Furthermore, the local authorities are also participants since PES will be introduced in the existing institution. In conclusion, it is important for the introduction of PES to know the position of FONAFIFO, the landowners, and the local authorities.

FONAFIFO is willing to implement PES in Rosario, Puerto Humo and Pozo de Agua, although there is one limitation (J. A. C. Moya, personal communication, 15/04/2011). Already, not all the requests for finance can be answered since they do not have enough financial resources. This makes it difficult to put more area under PES. This is also the reason why only the forests are protected at this moment and that they cannot protect the other kind of ecosystems.

The questionnaires and the interviews with the two inhabitants of Rosario and Puerto Humo concluded that the inhabitants are willing to implement PES, but they do not have the knowledge. Only 12% of the inhabitants are familiar with PES and the rest of the people do not know what it is. 61% is willing to implement PES, however, more education about the programme can increase this number.

This research discovered that the local authorities do not have a development plan for the region so the soil destination will not be a constraint for PES and the local authorities gave the approval to introduce PES in this region.

Knowledge about the biodiversity and the willingness to conserve these

The knowledge of the local communities about the biodiversity in the region is minimal. The only things the people know, is what their grandfathers and grandmothers told them (S. M. Ruiz, personal communication, 02/05/2011). However, some people just do not care about the biodiversity or the conservation of it, even if they have the knowledge (S.M. Ruiz, personal communication, 02/05/2011). Happily, there are also people who do care and act like this.

The Organization for Tropical Studies tries to educate the people and started a local network for environmental adaptation (R. Ramirez, personal communication, 13/05/2011). Each month they give education to local communities for more awareness about biodiversity and climate change. They especially focus on the education for children, so that they can tell this to their parents and most of all that they behave more environmentally friendly in the future. In 1974 the government started an education programme in schools to get more awareness about nature (J. Bravo, personal communication, 13/05/2011).

There are small tourists' rides from people with a boat and they give information to the tourists about the ecosystems (R. Ramirez, personal communication, 13/05/2011 and S. M. Ruiz, personal communication, 02/05/2011). These tourists' guides are aware of the fact that the tourists can have a negative impact on the animals, so they make sure that the tourists do not feed the animals to minimize the impact.

Besides the people who join PES and maybe some other inhabitants, the local communities are not familiar with PES (S. M. Ruiz, personal communication, 02/05/2011). Only four respondents of the 33 knew what PES was. More awareness about the programme is necessary before it will be introduced in this region. However, because of the limited financial capacity of FONAFIFO, they do not give education about PES as they are not able to give all the people a contract (J. A. Cubero Moya, personal communication, 15/04/2011). With a more stable financial market and with more financiers, PES can finance more areas and more education would be possible.

5.2.2 Conclusions of PES and the social environment

Although PES is not part of the current traditions; the local communities are willing to implement PES. Besides, it is not a struggle with the current traditions, norms and values. At present, the main economy is cattle and agriculture, although, even these two economies have a hard time to sustain. The division of land is diverse and contains both many landowners with small pieces of land and some landowners with big areas. The participants of this institution are FONAFIFO, the government and the landowners. If it is institutionally possible to implement PES, they are all willing to implement PES in Rosario, Puerto Humo and Pozo de Agua. However, the knowledge under the local communities is limited and there must be education before PES can be introduced.

The most important conclusions for the implementation of PES in the social environment are:

- PES is not a tradition, though; it is possible to implement PES according the norms and values.
- There is common understanding between the local communities.
- The economy is changing, but the biggest economy stays cattle and agriculture with a high unemployment rate.
- Diverse and private owned properties.
- 50% of the people are not able to implement PES due to the lack of land and/ or knowledge.
- FONAFIFO is willing to implement PES, however their capacity have to growth.
- The local communities are willing to implement PES, however they need more knowledge about the programme.
- The local authorities approve the implementation of PES.
- The most people are not familiar with PES.

5.3 PES and the natural environment

5.3.1 Results

The ecosystems

In Rosario, Puerto Humo and Pozo de Agua several ecosystems are represented like tropical dry forest, riparian forest, mangroves, wetlands and savanna (S. M. Ruiz, personal communication, 02/05/2011). Although all the ecosystems have a certain value, the wetlands are the most valuable for this area (also earlier stated in chapter 1 and 2). This, because they provide unique ecosystems services: flood protection, nutrient cycle and they are an important habitat for many species (Daniels and Cumming, 2008). However, the wetlands are decreasing worldwide and this makes it even more important to conserve the wetlands in the Rio Tempisque Basin.

The water for the different purposes comes from several sources in the area. The drinking water is groundwater, which is stored in water tanks (J. Bravo, personal communication, 13/05/2011). In some town there is an organisation that is in charge of the water. When there is not enough water, especially in the dry season, they can decide to make rules about the water use and on which times the water is available (S. M. Ruiz, personal communication, 02/05/2011). They also make sure that the water tanks will be cleaned once in a while. The cows get their water from the river and for this purpose the owner walks with the cows to the river and let them drink directly. Afterwards, they go back to their land and another group of cows are able to drink. When they are too far from the river, they drink surface or ground water. Agriculture also uses groundwater.



Figure 5.2 Cows drinking from the river.

Vulnerability context

Chapter 2 already discussed the effects of climate change in Costa Rica, nevertheless; also the questionnaires and the interviews proved that climate change is already happening.

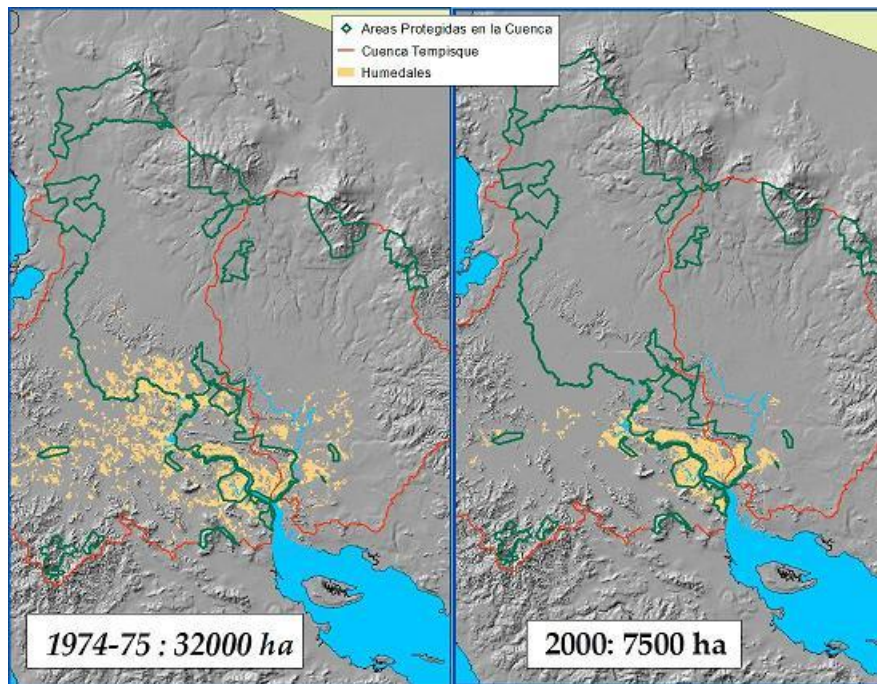


Figure 5.3 Change of the wetlands (GIS map of the Organisation of Tropical Studies, 2011).

Figure 5.3 shows the changes of the wetlands, which are especially disappearing further from the river. However, the wetlands are able to sustain next to the river as the river gives them enough water. Chapter 2 discussed the reasons for the decline of the wetlands: humans are the biggest threat next to climate change (Daniels and Cumming, 2008 and Jimenez, Gonzalez and Matao-Vega, 2001). Although the area of wetlands was 32 000 hectares in 1974-1975, the wetlands covered only 7 500 hectares in 2000 (map of Organisation for Tropical Studies, 2011), which is a loss of 77%. It is not sure if this change has occurred because of climate change given that there has no research been done about climate change till now. The Organisation for Tropical Studies started a research on climate change with a weather station but this research is started a year ago, so it is too soon to come with results (R. Ramirez, personal communication, 10/04/2011).

Climate change has as results that it is getting warmer and the summers are longer than some years ago. Besides, the wind is getting stronger, which increases the effects of climate change because it dries the soil even faster (J. Matarrita, personal communication, 27/04/2011). The temperature rise will cause effects on some species, some will disappear and some will extend to other region with better living conditions (N. Rodriguez Garro, personal communication, 07/05/2011).

Next to the official data, the local communities also record changes and record a higher temperature. Even 73% of the people who filled in the questionnaire, answered that the temperature is much higher in recent years. Besides, 63% of the people record a much drier or drier soil, which indicate the water shortage. Only the answers about the change in precipitation are not consistent, which can be explained by the fact that climate change results in more extreme weather (Enquist, 2002). The rain is not more or less, only at different times and with more extreme precipitation, which can be interpreted differently by people. These observations confirm the conclusions from other researches that climate change already affects the region.

Not only the weather is changing, but also the water temperature in the river is increasing. This has a negative influence on the water biodiversity, since this cause insignificant amount of oxygen for the fish to survive. The river Tempisque is also getting less deep through sediments and volcano ashes (J. Bravo, personal communication, 13/05/2011).

The wetlands are not only at risk because of human impact and climate change, but also other vegetation is in strong competition with the wetlands (N. Rodriguez Garro, personal communication, 07/05/2011). The wetlands are quickly overruled by other vegetation. This has a

negative influence on the biodiversity in the natural ponds, since they overrule the surface waters and create less area for water birds. The jabiru (a kind of stork) and the anteater are already in danger of extinction and they are decreasing rapidly in the Rio Tempisque Basin (J. Matarrita, personal communication, 27/04/2011).

The interviewed people strongly recommend other kind of income for the future to adapt to climate change. With cattle and agriculture they will not be able to stay in the area; the cattle have not enough grass and agriculture not enough water (J. Bravo, personal communication, 13/05/2011). Besides, also the local communities are willing to change their livelihood for climate adaptation.



Figure 5.4 Wetlands.

Patterns of interaction

The local communities do not taken special actions to protect the nature in the area. However, more education is given to the children lately and also the management plan tries to get more awareness for the urgency to protect the ecosystems. Even though the relation between the people and the ecosystems is not close, it can grow in the coming years.

5.3.2 Conclusions of PES and the natural environment

The wetlands are the most important ecosystems in Rosario, Puerto Humo and Pozo de Agua to sustain, since they have such a unique ecosystem services. Next to literature, also the local communities and local researchers mention climate change in Costa Rica, which is visible in increasing temperature, more extreme precipitation and a stronger wind. Sadly, besides climate change, also other species are in competition with the wetlands.

The most important conclusions for the implementation of PES in the natural environment are:

- The wetlands need to be protected, since these are the most important ecosystems.
- The local communities already mention climate change.
- The local communities do not conserve the ecosystems.

5.4 PES as an institution

5.4.1 Results

The organisation of PES

In 1995 the government of Costa Rica decided to put all the different environmental protection programmes in one, with one organisation. “The move was intended to make the management of priorities and funds clearer, more transparent, more flexible and more efficient” (FONAFIFO, 2005, p. 14). The Forestry Act No. 7575 of 1996 created PES and determined the most important elements of PES, like the goals and the different contracts. FONAFIFO was created to manage PES with as tasks fundraising and the investments in PES. One advantage of an organisation that manages PES that is

independent of the government is that it will not change with a different administration or new minister (FONAFIFO, 2005, p. 18). At the same time as the creation of FONAFIFO there came some other innovations that made PES possible. First the fuel tax and finance mechanism, like the international trade in CO₂, which made the financing of PES possible. Furthermore, trees and forests were accepted as items for loans of the national banking system (FONAFIFO, 2005).

The board of FONAFIFO consists of representatives of the Ministry of Environment, Energy and Telecommunication (MINAET), of the Ministry of Agriculture (MAG), of the National Banking System and two representatives of the private forest sector (appointed by the board of the National Forest Office) (Pagiola, 2006). These representatives are appointed for two years and can get re-elected. The Ministry of Finance must approve the budget of FONAFIFO. Furthermore, FONAFIFO is working close with the National Conservation Area System (Sistema Nacional de Areas de Conservacion, SINAC). This organization selects the landowners and is also responsible for deciding which areas must be under the priority zones (FONAFIFO, 2005). SINAC is also the organisation that helps to organise small landowners.

The head office of FONAFIFO is in the capital of Costa Rica, San Jose. Yet, there are also eight offices in other regions so that the organisation is more accessible and effective (FONAFIFO, 2005). There is no office of FONAFIFO in Nicoya, however MINAET is represented here and they are also able to inform people about PES and help people if there are questions concerning PES. MINAET has also a role in the monitoring, which will be discussed later in this chapter.

Financial market

PES can only be implemented sustainable when the finance is ensured on the longer term. The main part of the finances comes from the fuel tax that all Costa Rican pay, which is situated in the Tax Simplification and Efficiency Law # 8114, article 5. This law states that 3.5% of the fuel tax goes to PES (Rodriguez et al., 2005). There was also another tax that went to PES, the Forestry Law #7575, article 43 made this happen, which was a tax of 40% on timber, but this tax stood only for one year in 1998.

However, the fuel tax is not enough to finance the programme so FONAFIFO started immediately with the search for other financiers, like other governments. The finance comes among others from the government of Norway. They invest in PES for emission trading from 1997 onwards (Miranda, Porras and Moreno, 2003). There are three reasons why other countries invest in Costa Rica for emission trading instead of other developing countries; a long tradition of environmental policy, an active civil society and a stable policy (Steinberg, 2001). The long tradition makes the environmental policy in Costa Rica more reliable, the active civil society ensures the implementation and stable politics decrease corruption. These factors make it for countries attractive to invest in Costa Rica, nevertheless, there is also another side of the story that makes it for countries less interesting to invest in Costa Rica (J. A. Cubero Moya, personal communication, 15/04/2011). Costa Rica does not have a high deforestation rate anymore since there are several environmental laws and programmes that decreased the deforestation. Furthermore, Costa Rica has a middle economy what makes it less necessary for the foreign countries to invest in Costa Rica and they prefer to invest in poor countries with a high deforestation rate.

The World Bank invested \$40 million in the beginning of the 21st century to show their trust in PES (Sanchez- Azofeifa et al., 2007). This is a great amount and helped Costa Rica with the start of it.

Another big investor is the National Power and Light Company (Compania Nacional de Fuerzo y luz, CNFL), which invests in PES for the protection of the rivers that they use (FONAFIFO, 2005). They pay \$40 per hectares per year with a total area of 10 900 hectares. The hydroelectric company, Energia Global de Costa Rica S.A. invests in PES as well since they also need the rivers for their production and therefore have an interest in protecting the water quality. They started in 1997 and have a five-year contract of \$40 000 a year. Hidroelectrica Platanar has a contract for 10 years with FONAFIFO and they pay \$39 000 a year. Florida Ice and Farm need water for the brewery and bottling plant, fruit drinks and soft drinks and pay \$45 000 per year.

There are also (inter) national companies that invest in PES to get a 'certificate for environmental services' in return (Russo and Candela, 2006). This certificate makes that the companies get a greener image.

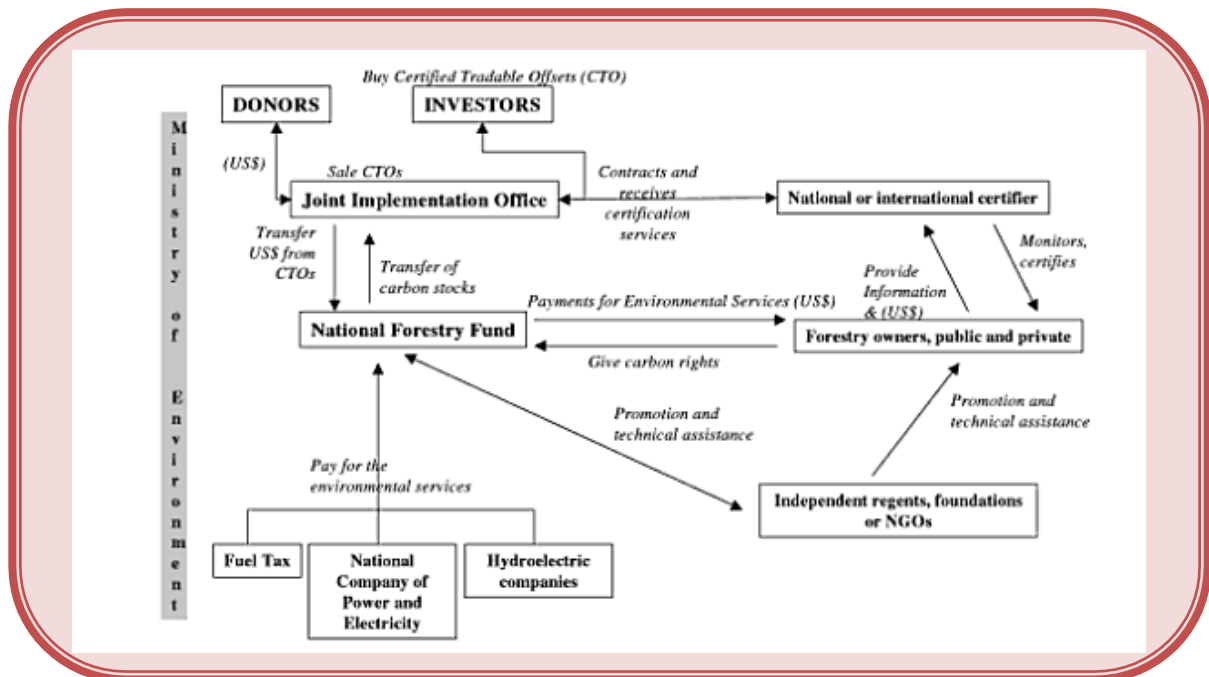


Figure 5.5 Finance of PES in Costa Rica (Miranda, Porras and Moreno, 2003).

When the government of Costa Rica started PES in 1996 they had a strong belief in the programme, yet now there are some external factors that have influence in the investments in PES. The people of Costa Rica have to pay a tax above the gas prices, but the price of gas is rising the last years. Therefore, there is a change that the government decide to take off the tax to reduce the gas price and this will lead to less money for PES (J. A. Cubero Moya, personal communication, 15/04/2011). However, it is not sure yet if the government will decide to stop the tax. To be sure about the finance in the future, FONAFIFO is taking much effort to promote PES and tries to get funding from other resources. Possibilities for this are the carbon or the biodiversity market (J. A. Cubero Moya, personal communication, 15/04/2011).

Ostrom's principles for a good institution

Ostrom (1990) identifies several principles for the working of an institution. An institution has to fulfil these principles in order to prevent the social dilemmas. An institution does not have to meet all these principles in order to be a successful institution, although this has the preference.

The first principle of Ostrom is that the boundaries of the resources must be clear. In western countries, it is difficult to imagine that boundaries of towns, villages and protected areas are not clear or do not exist. However, there is no registration of boundaries of villages or protected areas in Costa Rica and this makes it hard to talk about it, since nobody knows exactly how big it is, or even the number of inhabitants of a village. However, there is an organisation that registers the boundaries of the private properties, which is necessary for the implementation of PES (R. R. Quiros, personal communication, 16/01/2012). Furthermore, there are documents for the landowners of private properties, though this cannot be used as official documents. The organizations from the management plan are also trying to get all these boundaries measured and of the villages and protected areas (R. R. Quiros, personal communication, 22/07/2011). In conclusion, this principle is almost reached because the boundaries are registered but not precisely.

The second principle of Ostrom is that the rules must fit to the current conditions. FONAFIFO has a long history, which it still developing and they adjust the rules to the current situation

(FONAFIFO, 2005). The rules are also adjusted to the place, which is done by the different contracts. However, it is not adjusted to the different resources as it can only be used for forest.

The third principle of Ostrom is that the community has to participate in making rules. In Costa Rica, the civil society takes part in the discussion about PES. The Forestry Act has a history of 40 years and this act is frequently discussed to improve the protection of forest and reforestation (FONAFIFO, 2005). This discussion was not only between experts but also the civil society was involved.

The institutional rational choice theory emphasizes the importance of good monitoring and strict sanctions to prevent the prisoners' dilemma and the free-riders problem (Ostrom, 1990). FONAFIFO tries to do this as good as possible within their capacity. Before the start of the contract there is control by a forest engineer to see if the area meets the standards of FONAFIFO (J. A. Cubero Moya, personal communication, 15/04/2011). However, FONAFIFO does not have the capacity to monitor everyone under contract, since 1000-1500 people need to be monitored. For all that, FONAFIFO get help with monitoring from MINAET and SINAC. These two organisations have the goal to conserve nature, so they have to protect people from cutting and starting fires, even when the area is not under contract (J. A. Cubero Moya, personal communication, 15/04/2011). When they see that someone who joins PES does not keep to their contract, they inform FONAFIFO about it.

When a landowner does not comply with the contract, the first step is to approach the landowner and tell that they have to fix the problem, which is the fifth principle of Ostrom. When this does not help, FONAFIFO lowers the payment next year or sometimes the contract even stops (J. A. Cubero Moya, personal communication, 15/04/2011). This is also the reason that the payments are afterwards, so they have something to force the landowners to keep to the contract.

The next principle of Ostrom is that the institution has to solve conflicts, though FONAFIFO is not made to solve conflicts between people. However, if there are conflicts involving the contracts, the previously mentioned actions are taken.

The last principle of Ostrom is that the rules have to be clear through all levels of the organisation. As seen before, not all the landowners are aware of PES or the rules about PES. The people need information about PES before they are able to implement it.

5.4.2 Conclusions of PES as an institution

FONAFIFO is founded to protect forest or reforestation. The financiers of PES are diverse, but the biggest share is from the government through taxes. FONAFIFO is forced to search for other kind financiers to ensure the PES market. PES meets almost all the principles of Ostrom, only the boundaries are not clear, although they are working on this with the management plan. Also, not all the rules are clear to everyone, so education about PES is necessary.

The most important conclusions for PES as an institution are:

- The goal of FONAFIFO is to protect forest and reforestation.
- The financial market is stable at present, but it is not sure how this will be in the future.
- The boundaries of the resources are not clear, but the land properties are registered.
- The rules are adjusted to time, place and kind of resources.
- FONAFIFO monitors with help from MINAET and SINAC, however, limited.
- The sanctions are strict.
- FONAFIFO is not made to solve conflicts.
- The local communities have to be informed about PES.

5.5 Sustainable implementation of PES

5.5.1 Results

Sustainable livelihood

The payments for PES are already discussed in chapter 2, nevertheless there was no interpretation of these payments about the opinion of the Costa Rican about the height of this. The payments for PES are per hectare and depend on the kind of programme (forest conservation, natural regeneration,

reforestation or agroforestry systems). The payments are a nice extra for the people's normal income, but they cannot live of PES alone (J. A. Cubero Moya, personal communication, 15/04/2011). The payments are simple not enough to sustain a household and some people do not want to join PES because the payment is not enough.

Informal conversations with landowners in the rest of Costa Rica clarified that the most people who join PES are landowners with big areas of land. These people also stated that it is not possible to live from the finance of PES since the payments are limited. These landowners have parts of their land under contract of PES and the rest of their land is used for cattle or agriculture or other kinds of income. Even so, it was very remarkable that many people with PES are foreigners, who already came to Costa Rica to buy land and to turn this into protected area. So, even without payments they would have conserve nature.

Contract	\$/ ha/ year
Forest conservation	
Protection of forest	64
Protection of water resources	80
Protection of priority zones	75
Protection of forest with custom of the natural fruits	50
Natural regeneration	
Natural regeneration on pasture land, at least one year not in use	41
Reforestation for carbon credits	107
Reforestation	
Reforestation	196
Reforestation, only endemic species	294
Agroforestry systems (for one tree)	
Normal agroforestry systems	1.30
Agroforestry systems, only endemic species	1.95

Table 5.1 Payments for PES (J. A. C. Moya, personal communication, 20-06-2011)

The procedure to join PES is the same for everyone, even if the people have implemented PES before. The landowner has to contact FONAFIFO to show his interest and guarantee that he or she is the legal landowner. After the contact they hire a forest agency and they check of the area is suitable for PES and a forest engineer makes a contract (J. A. C. Moya, personal communication, 15/04/2011).

Because of the limited financial capacity it is not possible to put more area in the PES programme and this result in more demand than supply at the moment. However, there is not a kind of waiting list but everyone can try to get into the programme each year and if they do not make it this year, they can try it next year (J. A. C. Moya, personal communication, 15/04/2011). An area can get priority when they are pointed out by FONAFIFO. Those have a better chance to get a contract of PES. The people who already joined PES do not get priority to join the programme again but that have the same possibility as someone who applies for the first time (J. A. C. Moya, personal communication, 15/04/2011).

Conservation of the wetlands

FONAFIFO created the following goal (FONAFIFO, 2005, p. 22);

“The objective was to use loans and other mechanism for promoting the development of forest, disturbed or otherwise, and to provide small and medium-scale producers with financing for reforestation, planting of forest and nurseries, development of agro-forestry

systems, recovery of deforested areas and implementation of technological change, all for the productive use and industrialization of forest resources.

Another objective would be to obtain financing for environmental services payment programs, forest planting and other activities needed to strengthen the development of the natural resources sector.”

This goal makes is only possible to conserve forest or reforestation and it gives the opportunity to plant trees in agricultural land. The last part does suggests that it is possible to finance all environmental services, however, because of the limited financial capacity of FONAFIFO they do not have the capacity to promote other kind of ecosystems besides forests (J. A. C. Moya, personal communication, 15/04/2011).

5.5.2 Conclusion of the sustainable implementation of PES

For a sustainable implementation of PES, FONAFIFO must create a sustainable implementation of PES and the wetlands need to be conserved, the previous section however, gives the following conclusions:

- The payment for the implementation of PES is limited and it cannot be ensured that the landowner can join PES because of the limited capacity.
- FONAFIFO only protects forests.

5.6 Final analysis: opportunities and constraints for PES

The previous paragraphs presented the results of the interviews, questionnaires and the content analysis. This paragraph will analyse these results and split them up in opportunities and constraints. First, will be determined what the opportunities and constraints are for the implementation of PES in the institutional, social and natural environment. Second, PES will be criticized as institutions. Third, the opportunities and constraints of PES for the creation of a sustainable livelihood and for the conservation of the wetlands will be discussed.

The conclusions of the above mentioned results are regarded as an opportunity if PES can be implemented in the area without adjustments. The conclusion will be considered neutral if the variable is neither an opportunity nor constraint or if it is easy to solve the constraint. The variable will be considered as a constraint if PES cannot be implemented in these circumstances and if this problem is not easily solved. Furthermore, the variable is a constraint if it does not create a sustainable livelihood or if it does not conserve the wetlands and an opportunity if it does meet these criteria for a sustainable implementation.

Implementation of PES in the institutional environment

The most important elements of the institutional environment are:

- The laws and rules approve PES.
- There is no development plan, though a management plan is created.
- Illegal activities are decreasing, although still present.
- There are no companies in the area that can benefit from finance PES.
- PES is already implemented in Puerto Humo and Pozo de Agua.

The first variable is that the laws and rules approve PES, which creates an opportunity for PES. Both the national laws and the local laws and rules allow PES in this region.

There is no development plan that determines the different land uses for a specific region. The absence of this development plan gives landowners the freedom to implement whatever they want, so this gives an opportunity for PES. However, some local organisation and MINAET are developing a management plan to stimulate economic growth (R. R. Quiros, personal communication, 22/07/2011). This can be a big opportunity for PES if PES can be implemented in this plan.

The third variable is the fact that the illegal activities are decreasing and therefore creating more opportunities. Although there are still illegal activities, like starting fires, PES can reduce the incentives for these activities (S. M. Ruiz, personal communication, 02/05/2011). The landowners get more responsibility for their land and will thus invest more to protect it.

There are no companies that can benefit from investing in PES in Rosario, Puerto Humo, Pozo de Agua or the surrounding (S. M. Ruiz, personal communication, 12/12/2011). The presence of companies could have been an opportunity, but now it is neither an opportunity nor constraint.

Given the fact that PES is already implemented in Puerto Humo and Pozo de Agua, it makes it easier to implement PES in the region as the inhabitants who join PES can help to implement PES and promote it. Furthermore, this is an indicator that it is possible to implement PES in the region.

Implementation of PES in the social environment

The social environment contains the most important elements about the livelihoods of the local communities and their belief system. These variables are:

- PES is not a tradition, though; it is possible to implement PES according the norms and values.
- There is common understanding between the local communities.
- The economy is changing, but the biggest economy stays cattle and agriculture with a high unemployment rate.
- Diverse and private owned properties.
- 50% of the people are not able to implement PES due to the lack of land and/ or knowledge.
- FONAFIFO is willing to implement PES, however their capacity have to growth.
- The local communities are willing to implement PES, however they need more knowledge about the programme.
- The local authorities approve the implementation of PES.
- The most people are not familiar with PES.

The first variable is that PES is not part of the tradition in Rosario, Puerto Humo and Pozo de Agua, however, it is also not a constraint to start with PES according the traditions, norms and values. This is an opportunity for the implementation of PES in the existing institutions.

The second variable is common understanding, which is present in the three villages. For the implementation of PES this can be an opportunity, since it ensures social control between the communities and, in turn, can help prevent illegal activities. Furthermore, the local people can stimulate each other to join PES and can help each other with the implementation.

The economy in Rosario, Puerto Humo and Pozo de Agua is changing through the years but the main economy remains agriculture and cattle. According to the fact that these both need much water this is a constraint for the region, however it does not bother the implementation of PES as the landowners can switch from income. This variable will be neutral.

The properties in the area are privately owned, which is one of the conditions for the implementation of PES. Furthermore, the properties are diverse in size and this gives opportunities for both the big landowners as the small landowners, however the small landowners must organise themselves to join PES (N. Rodriguez Garro, personal communication, 07/05/2011).

The questionnaires concluded that 50% of the people are not able to implement PES, which means that they do not have the knowledge or that they do not own land. Since the reason is unknown, it is hard to tell if the problem can be solved. A lack of knowledge can be solved through education, but the absence of land is less likely to be solved. Because it is not clear how many people are landowners, this indicator will be neutral.

FONAFIFO is willing to implement PES in the area (J. A. C. Moya, personal communication, 15/04/2011), which is an opportunity. However, they have a limited capacity for contracts as it is financially impossible to put more area under contract. This is also the reason why the wetlands, or other ecosystems, cannot be protected by FONAFIFO. The willingness of FONAFIFO is an opportunity with a small constraint that they cannot ensure contracts for the local communities.

The local communities themselves are willing to implement PES, though they need more education. This is both an opportunity and a constraint since they are willing (opportunity) but need more education (constraint). This constraint can easily be solved by education so that this results in an opportunity for the implementation of PES.

Also the local authorities have approved the implementation of PES in Rosario, Puerto Humo and Pozo de Agua, which was already stated in the institutional environment.

The last variable is the local people's unfamiliarity with PES, which is a constraint, but can easily be solved through education so this will be neutral.

Implementation of PES in the natural environment

The most significant variables for the natural environment are:

- The wetlands need to be protected, since these are the most important ecosystems.
- The local communities already mention climate change.
- The local communities do not conserve the ecosystems.

A big constraint for PES is that the wetlands are the most unique ecosystem in the Rio Tempisque Basin since PES can only protect forest or stimulate reforestation (S. M. Ruiz, personal communication, 02/05/2011 and Daniels and Cumming, 2008). The protection of forest or reforestation will reduce the amount of wetlands, while these are unique in the world and need to be protected. However, the fact that the wetlands are the most unique in the region is not a constraint on itself, but the constraint is that PES can only protect forest and this will be evaluated by PES as an institution. For this reason, the presence of wetlands will be stated as neutral.

The local communities mention climate change and the wetlands are at risk by humans, climate change and by other vegetation (J. Matarrita, personal communication, 27/04/2011 and N. Rodriguez Garro, personal communication, 07/05/2011). These are neither an opportunity nor constraint for the implementation of PES, but do emphasise the need to protect the wetlands and provide a climate adaptation strategy.

The local communities do not protect the ecosystems, although it would be a smaller step in protecting the ecosystems with PES. However, the fact that they do not protect the ecosystems is not a constraint as this may change in the future.

PES as an institution

This part determines the opportunities and constraints of PES as an institution and whether or not PES meets the criteria of Ostrom for a good institution. These are the most important indicators for PES:

- The goal of FONAFIFO is to protect forest and reforestation.
- The financial market is stable at present, but it is not sure how this will be in the future.
- The boundaries of the resources are not clear, but the land properties are registered.
- The rules are adjusted to time, place and kind of resources.
- FONAFIFO monitors with help from MINAET and SINAC, however, limited.
- The sanctions are strict.
- FONAFIFO is not made to solve conflicts.
- The local communities have to be informed about PES.

The first variable is the goal of FONAFIFO: protect and promoting forest (FONAFIFO, 2005, p. 22). One criterion is that PES has to conserve the wetlands, a criterion which PES does not meet. FONAFIFO only protects forest and does not pay landowners to protect wetlands. This is a constraint for the implementation of PES in this area, since it would be a waste to plant trees and destroy the wetlands.

The second variable is the financial market, which is stable at present but cannot be ensured in the future (J. A. Cubero Moya, personal communication, 15/04/2011). This variable will be an opportunity since FONAFIFO is trying to get more financiers and the market is stable at present.

Ostrom made some principles for a good working institution to prevent the social dilemmas. The first principle is the registration of clear boundaries, which is not the case for the villages or protected area. Nevertheless, there is an organization that registers the private properties, which results in a neutral indicator (R. R. Quiros, personal communication, 16/01/2012).

The second principle is well fitting rules regarding time, place and kind of resource. The rules of FONAFIFO are adjusted to time because FONAFIFO update the rules ones in a while, adjusted to place through different contracts and adjusted to the different resources, which is forest (FONAFIFO, 2005).

Ostrom also emphasises the importance of good monitoring, which is done by FONAFIFO, MINAET and SINAC, but restricted by the limited capacity (J. A. Cubero Moya, personal communication, 15/04/2011). When the people do not comply with the contract, there are strict sanctions and the payments can be stopped. Monitoring with strict sanctions does meet the principles of Ostrom, though it could be better with more capacity.

Conflicts between people are solved by FONAFIFO and the people must solve their own conflicts.

The last principle is that the rules must be clear to the whole organization. This is the case with the people under contract, but most local people in Rosario, Puerto Humo and Pozo de Agua are not familiar with PES, which means that education about this programme is necessary.

The overall conclusion of PES with a comparison with the principles of Ostrom is that it is a good institution, with some small notes. It is necessary to monitor more and the conflicts between people need to be solved by FONAFIFO according Ostrom.

PES and a sustainable implementation

The criteria for a sustainable implementation of PES are a sustainable livelihood for the local communities and the conservation of the wetlands. The local communities must be able to stay in the region and cope with the vulnerabilities now and in the future. The criterion for the conservation of the wetlands means that the wetlands must be protected in the longer term. The previous paragraph gave the following results:

- The payment for the implementation of PES is limited and it cannot be ensured that the landowner can join PES because of the limited capacity.
- FONAFIFO only protects forests.

The payments for PES are minimal and do not ensure a stable income for the participants. The people are forced to earn an additional income besides PES. It is possible with the agroforestry contracts to combine agriculture and PES, however, the finance for this is also limited. Furthermore, this does not solve the problem of agriculture using too much water. The limited financial benefit is a constraint for the communities and will not ensure a stable economy in the future. Furthermore, FONAFIFO cannot ensure that the landowners can get a contract as the contracts are limited.

The second criterion is the conservation of the wetlands with PES. Equally as the previous criterion, this criterion can also not be ensured since PES only protects forests. The local people can get finance for reforestation or trees on their agricultural land, but this result in the disappearance of wetlands, while these are the most important ecosystems in this region and should not be changed into forest.

5.7 Conclusion

The discussion in the previous section leads to the following table with opportunities and constraints.

Concept	Indicator	Opportunity	Constraint
Institutional environment			
	Official rules and laws	PES is allowed	
	Development plan	No development plan, but they are making one	
	Illegal activities	Present, but decreasing	
	The presence of companies	Not in this area	
	PES in the area	PES is implemented in Puerto Humo and Pozo de Agua	
Social environment			
	Norms, values and traditions	It is possible according to the norms, values and traditions	
	Common understanding	High in the region	
	Economic situation	50% of the people is not able to implement PES	
	Costs and benefits		Finance for PES is minimal
	Landowners	Diverse and privately owned properties	
	Participants	FONAFIFO, the local communities and the local authorities are willing to implement PES	
	Position and knowledge	Knowledge of the local communities is limited	
Natural environment			
	Ecosystems	Wetlands are the most unique	
	Vulnerability	Climate change is already visible	
	Patterns of interaction	The ecosystems are not protected	
PES as an institution			
	Working of PES		Protecting forest
	Financial market	Stable but not ensured in the future	
	Ostroms principles	PES meets the most principles	
Sustainable implementation of PES			
	Sustainable livelihood		The payment of PES is limited
	Conservation of the wetlands		PES only protect forest

Table 5.2 Opportunities and constraints for PES.

The institutional environment has three opportunities and two neutral indicators. The local authorities approve the implementation of PES, there is no development plan preventing PES and PES is already implemented in Puerto Humo and Pozo de Agua. There are some illegal activities in the area, but since this is decreasing it is a neutral indicator. Furthermore, there are no companies in the area that can invest in PES.

The social environment is dominated by five opportunities, one constraint and one neutral indicator. It is possible within the present traditions, norms and values to implement PES. At the same time, the common understanding is high and this stimulates the communication and the people can help each other with the implementation. 50% of the people who filled in the questionnaire, answered that they are not able to implement PES. Since it is not clear what the reason is for this, this indicator stays neutral. The land sizes remains diverse, which result in the possibility for PES to be implemented. FONAFIFO, the local communities and the local authorities approve the implementation of PES. The constraint is that the payments of PES is limited and therefore requires another income beside PES.

The natural environment has two neutral indicators and one opportunity. Wetlands must be protected, but PES only protects forest and cannot protect the wetlands. The presence of wetlands is not necessarily bad, but it is not possible in combination with PES. The second indicator is that climate change is already visible and that the wetlands are at risk. Although this is a negative situation, it does not prevent the implementation of PES. An opportunity for PES is the fact that the ecosystems are not yet protected.

The goal of PES presents one of the biggest constraints, since its aim is to protect forest, while the wetlands are the most common and unique ecosystems in the research area. The other variables of PES are neutral or an opportunity. The financial market is stable, but is not ensured in the further. An opportunity of PES is that it meets most of Ostrom principles.

The biggest constraints for implementing PES are the criteria for a sustainable implementation. Although PES shows many opportunities compared to the present institutions, it cannot guarantee that it will be a sustainable implementation, because the payments are too limited to ensure a sustainable livelihood and FONAFIFO cannot protect the wetlands.

What all these opportunities and constraints means for the implementation of PES in the Rio Tempisque Basin will be discussed in the following chapter, chapter 6 conclusion, recommendation and reflection.

Chapter 6 Conclusion, recommendations and reflection

The first chapters of this masters' thesis concluded that the wetlands and the livelihoods of the local communities in the Rio Tempisque Basin are at risk because of human impact and climate change. The inhabitants use too much water for cattle and agriculture and climate change will increase this water shortage even more. These developments make the area too dry for wetlands to sustain and it is also a risk for the livelihoods of the local communities since there is not enough water for the cattle and agriculture. This research investigated the opportunities and constraints for the implementation of PES to create a sustainable livelihood and to conserve the wetlands in the future. In this research the following research question is answered:

What are the opportunities and constraints for payments for ecosystem services (PES) in order to provide a sustainable livelihood for the local communities and conserve the wetlands in the Rio Tempisque Basin?

Five sub questions have helped to answer this research question and were answered in chapter 2, 3 and 5. The answers on the sub questions will be resumed in this chapter. Chapter 5 already stated the answer on the research question about the opportunities and constraints, which will be repeated here.

Paragraph 6.2 contains recommendations for the government of Costa Rica and for FONAFIFO. This includes both recommendations to improve the livelihood of the local communities in the Rio Tempisque Basin as recommendations for FONAFIFO as an institution. 6.3 is a critical reflection on this research and provide subjects for further research.

6.1 Conclusions

6.1.1 Answers to the sub questions

1. What are the environmental problems in the Rio Tempisque Basin and why does this require a change of the economy in the area?

The Rio Tempisque Basin has developed itself through the years and although the industries have changed, the main economy remains agriculture and cattle (Jimenez, Gonzalez and Mateo-Vega, 2001). These two economies require a large amount of water and this results in scorching of the area and the disappearance of the wetlands. Besides, climate change intensifies these developments as the temperature will rise up to 4 °C and the precipitation will decrease with 27% in 2080 (Enquist, 2002). This will aggravate the situation for the wetlands and besides, it will not be possible to keep cattle and agriculture as there is not enough water. To conserve the wetlands and to create a sustainable livelihood for the local communities, an alternative income is required.

2. What is the working of PES and why can this be a possible solution?

PES is a programme that pays landowners for the environmental services of their land, like the conservation of ecosystems or for reforestation. PES especially focuses on the small and medium-scale producers (Sanchez- Azofeifa et al., 2007). This programme gives the local communities an income and at the same time conserves the ecosystems.

3. Which conceptual model can be developed from the interaction between the institutional rational choice theory and the sustainable livelihood approach?

The institutional rational choice theory and the sustainable livelihood approach can be combined in one conceptual model to show the relation between the concepts of the two theories. In this conceptual model the institutional, social and natural environment determine the present

institutions of the area and this leads to the action situation. To see if PES can be introduced in this existing institution, PES will be compared with the action situation. This comparison will lead to a situation where PES is implemented in the current situation. However, not only does PES have to fit the current situation, its purpose is to be sustainable as well. This is only possible when it creates a sustainable livelihood and it conserves the wetlands. Therefore, this comparison of PES with the action situation first goes through these criteria. Only when PES meets these criteria, as mentioned in chapter 1 and 2, it will be a sustainable implementation.

When it is possible to introduce PES in the action situation in a sustainable way, this will lead to opportunities. When this implementation is not possible in the action situation or when it will not lead to a sustainable livelihood or the wetlands will not be conserved, this will lead to constraints.

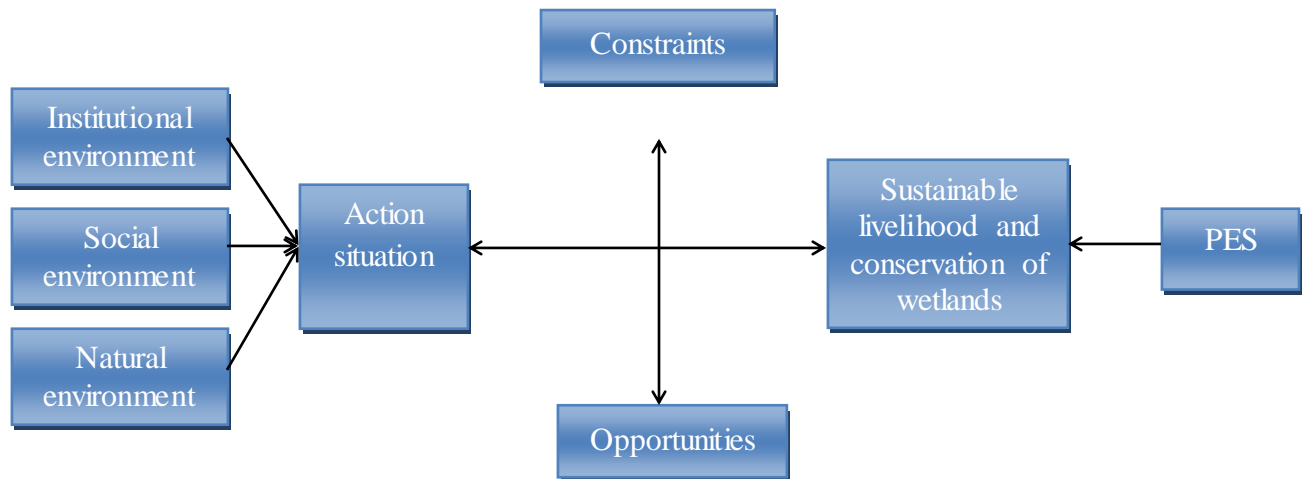


Figure 6.1 Conceptual model.

4. How is the action situation in Rosario, Puerto Humo and Pozo de Agua determined by the institutional, social and natural environment and how does PES meet the principles of Ostrom?

The institutional rational choice theory and the sustainable livelihood approach are combined in one conceptual model and this defined the institutions and resources by the institutional, social and natural environment. The institutional environment investigated that the laws and rules approve PES, that there is no development plan that can promote or prevent the implementation of PES (S. M. Ruiz, personal communication, 02/05/2011), the illegal activities are decreasing, there are no companies in the area that can benefit from PES, though this will not prevent the implementation of PES, and PES is already implemented in the region (S. M. personal communication, 12/12/2011). The social environment verifies that PES is not integrated in the present traditions, but that it is possible to implement PES within the traditions, norms and values of the local communities (J. Matarrita, personal communication, 27/04/2011 and H. Urieta, 15/05/2011), that the local communities have a common understanding, that cattle and agriculture is still the main economy (J. Matarrita, personal communication, 27/04/2011), that the land properties are diverse and that the participants approve PES, though more knowledge is required. The natural environment concluded that the wetlands are the most important ecosystems (J. Bravo, personal communication, 13/05/2011), but that they are decreasing, that the effects of climate change is already visible and that the local communities do not protect the environment at this moment.

Ostrom developed principles to determine if an institution is suitable to prevent the social dilemmas. PES meets these principles very well and the boundaries of the resources are registered, the rules are adjusted to time, place and kind of resources, the civil society is participating when making rules, monitoring is done though it is limited, there are strict sanctions when breaking the

rules and the rules are clear through the organisation. FONAFIFO only does not solve conflicts between landowners.

5. In what extent does PES meet the criteria of a sustainable livelihood and the conservation of the wetlands?

PES does, sadly enough, not meet the sustainability criteria. The payments are limited and are not enough for a sustainable livelihood. Furthermore, FONAFIFO cannot give all the landowners a contract since they do not have the capacity to do so. Besides, PES does not protect the wetlands, but only forest, while it is determined in chapter 2 and 5 that the wetlands are unique and are threatened worldwide and therefore must be protected. PES can only be beneficial with more finance, because with a bigger financial capacity it is possible to give the landowners more income and to protect other ecosystems besides forests.

6.1.2 Answer to the research question

Now that the sub questions are answered, the research question can be answered:

What are the opportunities and constraints for payments for ecosystem services (PES) in order to provide a sustainable livelihood for the local communities and conserve the wetlands in the Rio Tempisque Basin?

A conclusion is regarded as an opportunity if PES can be implemented in the area without adjustments. The conclusion will be considered neutral if the variable is neither an opportunity nor constraint or if it is easy to solve the constraint. The variable will be considered as a constraint if PES cannot be implemented in these circumstances and if this problem is not easily solved. Furthermore, the variable is a constraint if it does not create a sustainable livelihood or if it does not conserve the wetlands and an opportunity if it does meet these criteria for a sustainable implementation.

Opportunities for PES

The first opportunity for PES is that PES is allowed by the official rules and laws. The national laws approve PES in Costa Rica and informal interviews with the local authorities concluded that PES is also accepted within the local laws and rules.

Costa Rica does not have a development plan, which is neither a constraint nor an opportunity, since it does not approve PES but also not refuse the implementation of it. Though, some organisations are making a management plan for the region for the development of the area and this can be an opportunity when PES can be introduced in this plan.

PES is already implemented in Puerto Humo and Pozo de Agua with a total area of 247.6 hectares, which indicate that it is possible to implement PES in the area.

Although PES is not part of the local traditions, it is accepted by the norms and values of the local communities. The local communities approve the implementation of PES.

Furthermore, the local communities have a high common understanding, which is, according to Ostrom (1990), important within a community. Common understanding results in a good communication and the people can help each other with the implementation of PES and can stimulate each other to implement PES.

The area in Rosario, Puerto Humo and Pozo de Agua is private property, which give an opportunity for PES since it is required for PES that the land is private property. Furthermore, the land areas are diverse with some big properties and many small areas. These big areas can be under contract of PES without adjustments. The small properties give the possibility for many landowners to join PES, however, it requires that the landowners organise themselves as PES commits a minimum land size.

The willingness of the participants is a big opportunity since FONAFIFO, the local communities and the local authorities are willing to implement PES in the region.

Another opportunity is not an opportunity immediately, but the problem can be solved easily. Namely, the knowledge of the local communities is limited but this can be solved with more education.

The last opportunity is that FONAFIFO meets almost all principles of Ostrom. The boundaries of the landowners are registered, FONAFIFO adjusts the rules to time, place and resources, FONAFIFO monitors the implementation of PES and there are strict sanctions when the rules are broken. The two principles of Ostrom that FONAFIFO not fulfil are that FONAFIFO does not solve conflicts, neither are they given education about PES. However, since four principles do meet the principles of PES and only two principles are not fulfilled, the result is that FONAFIFO is a good institution according to Ostrom's principles.

Constraints for PES

All this together makes it institutional possible to implement PES in the region, however its purpose is to be sustainable as well and this results in two constraints. The payments for PES are limited and PES only protects forest, while the wetlands are the most valuable in the Rio Tempisque Basin.

The aim of this research is that PES creates a sustainable livelihood for the local communities and this contains the certainty of income both now and in the future. However, the payments for PES are minimal so the landowners are forced to keep another income besides PES while this is difficult in this area because of the high unemployment. Furthermore, PES cannot ensure that they get a contract due to the limited financial capacity. Consequently, PES cannot ensure a sustainable livelihood.

The other aim of this research is the conservation of wetlands, because it is stated that these ecosystems are the most unique in the area. However, PES only protects forests and cannot protect the wetlands. Furthermore, PES can be combined with agriculture and this can solve the above mentioned problem, nevertheless this will be at the expense of the conservation of the wetlands.

Research objective

The previous section is the answer on the research question. Nevertheless, the objective of this research is to contribute to a sustainable development of Costa Rica by analysing the possibilities of the implementation of payments for ecosystem services in the Rio Tempisque Basin. However the implementation of PES in the Rio Tempisque Basin is institutional possible, two big constraints make that the implementation of PES does not contribute to a sustainable development. PES will not provide a sustainable livelihood since the payments are minimal. Furthermore, it will not conserve the wetlands since PES only protects forests and does not protect other kind of ecosystems. Though, this last constraint is not negative for whole Costa Rica when Costa Rica's goal is to conserve forest.

As conclusion, with the results of this research, PES seems not capable of creating a sustainable livelihood for local communities or to conserve the wetlands. However, a sustainable development of Costa Rica does not necessarily mean that only the wetlands need to be protected and when Costa Rica's only goal is to conserve nature in general, PES can be helpful. Nevertheless, it will still not create a sustainable livelihood.

With the present finances for PES, FONAFIFO is not able to give the landowners more income, furthermore, it is with the present finance not possible to put more types of ecosystems under contract, while FONAFIFO is positive about protecting the wetlands (J. A. Cubero Moya, personal communication, 15/04/2011). Just like every problem in the modern world, this can be solved with more financial goods.

6.2 Recommendations

One possibility for PES in the region is the combination with ecotourism. Ecotourism can be combined with PES, for example tourist trips through the wetlands, and this can provide an additional income for landowners. Saskia Wiegiers of the Radboud University of Nijmegen has done research about the implementation of ecotourism in Rosario, Puerto Humo and Pozo de Agua and it

seems that ecotourism can be implemented in the area with some adjustments. Further research will be necessary to see if these two can be combined or if PES can be combined with something else.

A recommendation for the government of Costa Rica is to search for other kind of incomes for the local communities that are sustainable and that do provide a sustainable livelihood for the local communities. It is especially important that this income also protects more kinds of ecosystems than only forest.

Another strong recommendation for FONAFIFO is to find new financiers to raise the payments for PES and furthermore, to put more types of ecosystems under contract. In an interview with an employee of FONAFIFO, the employee indicated that they are interested in protecting more types of ecosystems (J. A. Cubero Moya, personal communication, 15/04/2011).

Furthermore, one goal of FONAFIFO is to focus on small and medium scale producers (Sanchez- Azofeifa et al., 2007). Currently, mostly landowners with large areas of land join PES and these had already the intention to conserve their land. Instead, FONAFIFO must try to stimulate the small landowners to join PES and give them income.

6.3 Reflection

Theoretical and methodical reflection

This section contains a critical reflection on the research and will start with a reflection on the theories that are chosen. At the start of this research it became clear that the institutional rational choice theory should be used to answer the research question as it connected well with this research. Nevertheless, the theory stays vague in literature and Ostrom does not explain the theory or the IAD framework in detail. This makes it for the researcher more difficult as it is hard to tell the exact indicators for the concepts. Though, it also makes it easier for the research as it leaves more room for interpretation. Although the researcher has given an own interpretation of the concepts of Ostrom, hopefully, Ostrom can approve this.

Before the observation in the field, it was assumed that only the institutional rational choice theory would be used. With this theory in mind, the interview guidelines and questionnaires were made. However, it turned out that this theory does not cover all the aspects of this research. It does give explanations and interpretation for the institutional and environmental side of the problem, but does not focus on the livelihoods of the local communities. However, it turned out that the sustainable livelihood approach does focus on these aspects and that the theory does match, more than expected, with the data that was gathered with the questionnaires. Furthermore, the institutional rational choice theory and the sustainable livelihood approach seem to be a good combination.

A research in a foreign country with a different language brings problems concerning the language. In Costa Rica the main language is Spanish and since Saskia Wieggers and I both do not speak this fluently this raise some questions about the validity and reliability. To solve this problem, the researcher have used translators and tried to use the same translators consistently to reduce accidental errors. Furthermore, the translators spoke good English, which made it more reliable.

This research was done in Rosario, Puerto Humo and Pozo de Agua and as a result these conclusions are not generalizable. The three villages are comparable and are not a good representative of the whole Rio Tempisque Basin. Hence, the results will only be helpful for villages with the same characteristics.

Recommendations for further research

An interesting research would be the finance of FONAFIFO. The first subject could be the stability of the financial market. Second, and this is even more important, to see how the finance for FONAFIFO can be increased and the third subject could be to investigate the motives of financiers to finance PES. As mentioned in this research by J. A. Cubero Moya (personal communication, 15/04/2011) the carbon and biodiversity market could be an interesting opportunity.

This research has used two theories that are not combined before: the institutional rational choice theory and the sustainable livelihood approach. In this research it seems that the theories can

be used together, although it must be further investigated. Environmental problems and poor people are often related with each other, because for example, activities with a high environmental/health risks are situated in the neighbourhood of poor people since these people neither have the knowledge, nor the money to fight against these activities (Yearley, 1996). Furthermore, environmental risks are higher in poor countries and poor areas since they have not the money to protect themselves against this. Therefore, the solution of environmental problems and the creation of a sustainable livelihood are inextricably linked. When looking at environmental issues, the creation of a sustainable livelihood should be considered as well, and therefore, both theories have to be used: the institutional rational choice theory and the sustainable livelihood approach. Further research is recommended to combine these two approaches or even to try to reconstruct them in one new theory.

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Appendix 1 Interviews

Name	Organisation	Subjects	Date
Rafael Ramirez	Organisation for Tropical Studies	Biodiversity, local community community and PES	10/04/2011
Jose Alberto Cubero Moya	FONAFIFO	PES	15/04/2011 and 20/06/2011
Jorge Matarrita	Works with tourists in the area	Area and local communities	27/04/2011
Norma Rodriguez Garro	MINAET	Biodiversity, area and PES	07/05/2011
Santos Molina Ruiz	ICT (Instituto Costarricense de Turismo)	Area, biodiversity, local community and PES	02/05/2011 and 12/12/2011
Jose Angel Jimenez and Ana Saray Briceno Cardenas	MINAET	Area and PES	03/05/2011
Juan Bravo	National University of Costa Rica	Area, water, biodiversity and possibilities for PES	13/05/2011
Hernan Urieta	Inhabitant of Puerto Humo	Willingness to implement PES	15/05/2011
Adolfo Salinas	CEDEME	Boundaries of the area	01/07/2011
Rigoberto Rodriguez Quiros	CEMEDE	Management plan	22/07/2011 and 16/01/2012

Appendix 2 Indicators and interview and questionnaire questions

This table contains the operational questions of this research and it shows a separation between the questionnaires and the interviews and content analysis. The questionnaires were given to the inhabitants of the three villages and contain closed questions. The interviews were held with the authorities and researchers and contain open questions. The content analysis also contains open questions and has the same questions as the interview questions. To the interviewed people from the communities were given the same questions as the questionnaires.

These questions are asked to answer the research questions. However, the order of rank in the questionnaires and interviews is different than represented here and more logic. To show the relation with the dimensions, it is represented this way.

Variable	Source	Questions
Institutional environment		
Rules and laws	Questionnaire	I. Is it politically possible to implement PES (is it allowed by law)? <input type="radio"/> Yes <input type="radio"/> No
	Interviews and content analysis	1. Do the communities have an own municipality or are they connected to Nicoya? 2. Is PES possible within the existing laws and rules?
Development plan	Interview	3. Is there something like a development plan, which gives a destination for the ground in the area? And how does PES fit in this?
Illegal activities	Interviews	4. Are there many illegal activities in the area (fires, hunting)? 5. What does the local authority do to prevent these illegal activities (like fires)?
Companies	Interview	6. How many companies are present in the area? 7. How much are they willing to pay to FONAFIFO to protect the area?
Implementation of PES in the region	Interview	8. Where PES already implemented in Rosario, Puerto Humo or Pozo de Agua?
Social environment		
Norms, values and traditions	Questionnaire	II. Which option is the most valuable for you? <input type="radio"/> Income <input type="radio"/> Biodiversity <input type="radio"/> Family <input type="radio"/> The community III. Is it socially possible to implement PES? Does PES fit with the norms of the community? <input type="radio"/> Yes <input type="radio"/> No
	Interviews and content analysis	9. What are the norms and values of the community? 10. How does PES fit into this? 11. Is PES accepted by/ acceptable for the people in the community?
Common	Questionnaire	IV. What is the main source of income in your community at

understanding		<p>present?</p> <ul style="list-style-type: none"> ○ Tourism ○ Ecotourism ○ Payments for Ecosystem Services ○ Agriculture ○ Cattle ○ Fishery ○ Forest ○ Other
Economic situation	Questionnaire	<p>V. What is your source of income at the moment?</p> <ul style="list-style-type: none"> ○ Tourism ○ Ecotourism ○ Payments for Ecosystems Services ○ Agriculture ○ Cattle ○ Fishery ○ Forest ○ No income or other <p>VI. How is your work organised?</p> <ul style="list-style-type: none"> ○ Chief without employees ○ Chief with employees ○ Employee ○ Unemployed ○ Other <p>VII. Are you already implementing PES?</p> <ul style="list-style-type: none"> ○ Yes, which %..... ○ No <p>VIII. Is it financial possible to implement PES?</p> <ul style="list-style-type: none"> ○ Yes ○ No
	Interviews and content analysis	12. What is the main economy of the area?
Landowners	Questionnaire	<p>IX. Is it managerially possible to implement PES (Are you the owner of the land, do you have enough knowledge and the capacity)?</p> <ul style="list-style-type: none"> ○ Yes ○ No
	Interviews and content analysis	<p>13. What is the size of the population of the three communities?</p> <p>14. How big is the average size of the property per family? (Lots of people with little areas, or a few people with big areas and what is the division?)</p> <p>15. What type of area is the area around Puerto Humo, Rosario, Pozo de Agua and Angeles? (Is it private property, public or protected?)</p>
Participants	Interviews and content analysis	<p>16. Who are the participants of this action situation and what is there attitude towards the institutions and PES?</p> <p>17. Who has influence on the ecosystems?</p>
Position and knowledge	Questionnaire	<p>X. If you have to change your livelihood, which alternative do you prefer?</p> <ul style="list-style-type: none"> ○ Tourism

		<ul style="list-style-type: none"> ○ Ecotourism ○ Payments for Ecosystem Services ○ Agriculture ○ Cattle ○ Fishery ○ Other <p>XI. Are you familiar with PES?</p> <ul style="list-style-type: none"> ○ Yes ○ No <p>XII. What is your opinion about PES?</p> <ul style="list-style-type: none"> ○ Positive ○ Neutral ○ Negative
	Interviews and content analysis	<p>18. Are people familiar with PES and how are people informed about it?</p> <p>19. Do the local communities care about the biodiversity in the region?</p> <ul style="list-style-type: none"> ○ Are they working on the protection of the biodiversity? (How?) <p>20. Do you think the people are willing to implement PES?</p>
Natural environment		
Ecosystems	Interviews and content analysis	<p>21. What kind of ecosystems are there in the region?</p> <p>22. What is the situation of the biodiversity in the region at this moment?</p> <p>23. Where do local communities get their water from, for cattle, households and other activities?</p>
Changes	Questionnaire	<p>XIII. Have you seen effects of climate change?</p> <ul style="list-style-type: none"> ○ Yes ○ No <p>XIV. Fill in the extent of noticed changes.</p> <p>Rain:</p> <ul style="list-style-type: none"> ○ Much more rain ○ More rain ○ No change ○ Less rain ○ Much less rain <p>Temperature:</p> <ul style="list-style-type: none"> ○ Much warmer ○ Warmer ○ No change ○ Colder ○ Much colder <p>Soil:</p> <ul style="list-style-type: none"> ○ Much dryer ○ Dry ○ No change ○ Wetter ○ Much wetter <p>XV. Do you think you have to change your income because of climate change?</p>

		<ul style="list-style-type: none"> ○ Yes ○ No <p>XVI. Have you seen changes in the area because of human impact (agriculture, cattle, fishery, hunting)?</p> <ul style="list-style-type: none"> ○ Yes, which..... ○ No <p>XVII. Do you think you have to change your work in the future because of the human impact?</p> <ul style="list-style-type: none"> ○ Yes ○ No
	Interviews and content analysis	<p>24. Is there proof of changes over the last few years?</p> <ul style="list-style-type: none"> ○ Change because of climate change? ○ Change because of human impact? ○ What kind of changes? ○ Are changes visible in the biodiversity? <p>25. Will there be problems in the future because of climate change?</p> <p>26. Do you think it is necessary to provide another way of income/land use for the local communities?</p> <ul style="list-style-type: none"> ○ In what way? <p>27. Is it possible to conserve the wetlands in the future with PES despite of the changes?</p>
Patterns of interaction	Interviews and content analysis	28. Are the people already protecting the environment?
PES		
Working of PES	Interviews and content analysis	<p>29. How is PES organised?</p> <p>30. For what kind of environmental services can PES be used?</p>
Finance	Interviews and content analysis	<p>31. Who invests in PES?</p> <p>32. What will this market look like in the future?</p>
Ostroms principles	Interviews and content analysis	<p>33. How are the boundaries of the lands registered?</p> <p>34. How are the rules adjusted to time, place, resources, etc?</p> <p>35. How do you monitor the people who join PES?</p> <p>36. What are the sanctions when breaking the rules?</p> <p>37. How does FONAFIFO solve conflicts?</p> <p>38. Are the rules clear in the different levels of organisation?</p>
Sustainable implementation of PES		
Sustainable livelihood	Questionnaire	<p>XVIII. For how much income are you willing to implement PES?</p> <ul style="list-style-type: none"> ○ Less than present ○ The same as present ○ More than present
	Interviews	39. Do you think the payments of PES are enough to get the people enthusiastic?
Conservation of the wetlands	Interview and content analysis	40. For what kind of environmental services can PES be used?

Appendix 3 Spanish questionnaire

Formulario de encuesta

Nr. Date.

Presentación

Somos dos estudiantes de ciencias sociales y políticas del medio ambiente en la Universidad de Nijmegen en los Países Bajos. Estamos haciendo una investigación sobre Pagos de Servicios Ambientales (PSA) y el ecoturismo y su adaptación al cambio climático en este ámbito. Para completar esta investigación estamos recogiendo datos en la Cuenca Rio Tempisque.

El objetivo de esta encuesta es obtener puntos de vista en las percepciones e interpretaciones de las comunidades locales sobre los cambios ecológicos en este ámbito y la opinión de la utilización de los Pagos de Servicios Ambientales (PAS) y el ecoturismo como una solución de los cambios en recursos naturales y uso de la tierra. En general, las preguntas serán acerca de estos recursos naturales, servicios de los ecosistemas naturales de los ecosistemas y su opinión acerca de esto.

Toda la información dada por el demandado se utilizará de forma anónima y protegida de cualquier manera.

Información personal:

Nombre + Apellidos: Mujer/ Hombre

Edad:.....

Población:.....

Por favor, lea esto con cuidado

☐ Biodiversidad

Todos los animales y la vegetación juntos.

☐ Cambio del clima

Se llama cambio climático a la modificación del clima con respecto al historial climático a una escala global o regional. Tales cambios se producen a muy diversas escalas de tiempo y sobre todos los parámetros climáticos: temperatura, precipitaciones, nubosidad etc.

Por favor, trate de completar las 24 preguntas lo más preciso posible. Lea la pregunta respuesta en el rango dado.	
INCOME	
1.	¿Cuál es su fuente de ingresos en este momento? <ul style="list-style-type: none"> <input type="checkbox"/> Turismo <input type="checkbox"/> Ecoturismo <input type="checkbox"/> Pagos de Servicios Ambientales <input type="checkbox"/> Agricultura <ul style="list-style-type: none"> ○ ¿Cuál? <input type="checkbox"/> Ganadería <input type="checkbox"/> Pesca <input type="checkbox"/> Forestal <input type="checkbox"/> No tengo ingresos <input type="checkbox"/> Otro.....
2.	¿Cuál es la fuente más importante de ingresos para su comunidad en la actualidad? <ul style="list-style-type: none"> <input type="checkbox"/> Turismo <input type="checkbox"/> Ecoturismo <input type="checkbox"/> Pagos de Servicios Ambientales <input type="checkbox"/> Agricultura <ul style="list-style-type: none"> ○ ¿Cuál? <input type="checkbox"/> Ganadería <input type="checkbox"/> Pesca <input type="checkbox"/> Forestal <input type="checkbox"/> No tengo ingresos <input type="checkbox"/> Otro.....
3.	¿Cómo está organizado su trabajo? <ul style="list-style-type: none"> <input type="checkbox"/> Jefe, sin empleados <input type="checkbox"/> Jefe, con empleados <input type="checkbox"/> Empleado <input type="checkbox"/> Desempleado <input type="checkbox"/> Otro.....
4.	¿Clasifique las siguientes opciones según su importancia para usted. 1 es la más importante, 4 la menos importante? <ul style="list-style-type: none"> a. Ingresos b. Biodiversidad c. Familia d. Su comunidad
LOS CAMBIOS EN EL ÁREA Y LA BIODIVERSIDAD	
5.	¿Usted ha visto los efectos del cambio del clima? <ul style="list-style-type: none"> <input type="checkbox"/> Sí (Sigue a la pregunta 6) <input type="checkbox"/> No (Sigue a la pregunta 7)

6.	Según su percepción cuál ha sido el grande de cambia en las siguientes opciones.		
	Las precipitaciones <input type="checkbox"/> Ahora llueve mucho más <input type="checkbox"/> Ahora llueve más <input type="checkbox"/> No hay ningún cambio <input type="checkbox"/> Ahora llueve menos <input type="checkbox"/> Ahora llueve mucho menos	La temperatura Ahora es mucho más caliente <input type="checkbox"/> Ahora es más caliente <input type="checkbox"/> No hay ningún cambio <input type="checkbox"/> Ahora es menos caliente <input type="checkbox"/> Ahora es mucho menos caliente	Del suelo <input type="checkbox"/> El suelo está mucho más seco <input type="checkbox"/> El suelo está más seco <input type="checkbox"/> No hay ningún cambio <input type="checkbox"/> El suelo está más húmedo <input type="checkbox"/> El suelo está mucho más húmedo
7.	¿Cree usted que su actividad/ trabajo se verá afectada debido al cambio climáticos? <input type="checkbox"/> Sí <input type="checkbox"/> No		
8.	¿Ha visto cambios en el área debido al impacto humano (agricultura, ganadería, pesca, caza)? <input type="checkbox"/> Sí ¿Cuáles cambios? <input type="checkbox"/> No		
9.	¿Cree usted que su actividad/ trabajo se verá afectada debido al impacto humano? <input type="checkbox"/> Sí <input type="checkbox"/> No		
10.	A) ¿Usted ya está cambiando su medio de vida a causa del cambio del clima o al impacto humano? <input type="checkbox"/> Sí (Sigue a la pregunta B) <input type="checkbox"/> No (Sigue a la pregunta 11)		
	B) ¿Cómo?		
11.	¿Si hay una necesidad de cambio, que fuentes alternativas de ingresos preferiría? <input type="checkbox"/> Turismo <input type="checkbox"/> Ecoturismo <input type="checkbox"/> Pagos de Servicios Ambientales <input type="checkbox"/> Agricultura <input type="checkbox"/> Ganadería <input type="checkbox"/> Pesca <input type="checkbox"/> Forestal <input type="checkbox"/> Otro.....		

PAGOS DE SERVICIOS AMBIENTALES (PSA)

Pagos de Servicios Ambientales son pagos que reciben propietarios por proteger la naturaleza. El propietario recibe dinero cuando él o ella proporciona algunos servicios: protección de la biodiversidad, el almacenamiento de carbono, protección de cuencas hidrográficas o la protección de la belleza escénica.

Modalidades	Monto (\$) /ha
Protección de Bosque	64
Regeneración Natural	41
Reforestación	816
Sistemas Agroforestales (monto por árbol, las otras modalidades se pegan por hectárea)	1.3

12.	<p>A) ¿Está usted familiarizado con PSA?</p> <p><input type="checkbox"/> Sí (Sigue a la pregunta B)</p> <p><input type="checkbox"/> No (Sigue a la pregunta 13)</p> <p>B) ¿Está usted utilizando PSA actualmente?</p> <p><input type="checkbox"/> Sí (Sigue a la pregunta C)</p> <p><input type="checkbox"/> No (Sigue a la pregunta 13)</p> <p>C) ¿Qué porcentaje de sus ingresos proviene de PSA?</p> <p>.....%</p>
13.	<p>¿Cuál es su opinión sobre PSA?</p> <p><input type="checkbox"/> Positivo</p> <p><input type="checkbox"/> Negativo</p> <p><input type="checkbox"/> Neutral</p>
14.	<p>¿Cuál es su opinión sobre la influencia de PSA sobre la biodiversidad?</p> <p><input type="checkbox"/> La biodiversidad disminuye</p> <p><input type="checkbox"/> La biodiversidad seguirá siendo igual</p> <p><input type="checkbox"/> La biodiversidad aumentará</p>
15.	<p>¿Cuál es su opinión sobre la influencia de PSA sobre la comunidad?</p> <p><input type="checkbox"/> Influencia positiva</p> <p><input type="checkbox"/> Ninguna influencia</p> <p><input type="checkbox"/> Influencia negativa</p>
16.	<p>A) ¿Quisieras trabajar con PSA?</p> <p><input type="checkbox"/> Sí</p> <p><input type="checkbox"/> No</p> <p>B) ¿Cuánto debería ganar con el PSA para que sea interesante para usted?</p> <p><input type="checkbox"/> Menos que la actualidad</p> <p><input type="checkbox"/> Lo mismo que en la actualidad</p> <p><input type="checkbox"/> Más que en la actualidad</p>

17.	<p>¿Desde los siguientes puntos de vista (financiero, social, político, de gestión) cree usted que es posible la aplicación de PSA?</p> <p>Financiero</p> <p><input type="checkbox"/> Sí</p> <p><input type="checkbox"/> No</p> <p>Social (¿Se ajusta a las normas de la comunidad?)</p> <p><input type="checkbox"/> Sí</p> <p><input type="checkbox"/> No, porque.....</p> <p>Político (¿Está permitido por la ley?)</p> <p><input type="checkbox"/> Sí</p> <p><input type="checkbox"/> No</p> <p>De gestión (¿Es posible en las condiciones actuales: Eres el dueño de la tierra, el conocimiento, la capacidad?)</p> <p><input type="checkbox"/> Sí</p> <p><input type="checkbox"/> No, porque.....</p>
ECOTURISMO	
18.	<p>¿Cree usted que el ecoturismo es?</p> <p><input type="checkbox"/> Ambientalmente responsables</p> <p><input type="checkbox"/> Económicamente responsables de las organizaciones turísticas</p> <p><input type="checkbox"/> Beneficiosos para la comunidad local</p> <p><input type="checkbox"/> Los tres</p> <p><input type="checkbox"/> Ninguno</p>
<p>Ecoturismo en esta investigación, no sólo se centra en el medio ambiente y los beneficios económicos del país o de las organizaciones de turismo. También involucra a las comunidades locales. Los beneficios del ecoturismo son devueltos a las comunidades y estas son compensadas por sus pérdidas en los recursos. Dentro de ecoturismo basado en la comunidad hay satisfacción por las necesidades, preocupaciones y el bienestar de la población de acogida en el corto y largo plazo.</p>	
19.	<p>A) ¿Está usted trabajando con ecoturismo?</p> <p><input type="checkbox"/> Yes (Sigue a la pregunta B)</p> <p><input type="checkbox"/> No (Sigue a la pregunta 20)</p> <p>B) ¿Qué porcentaje de los ingresos que viene del ecoturismo?</p> <p>.....%</p>
20.	<p>¿Cuál es su opinión sobre el ecoturismo?</p> <p><input type="checkbox"/> Positivo</p> <p><input type="checkbox"/> Negativo</p> <p><input type="checkbox"/> Neutral</p>

21.	¿Cuál es su opinión sobre la influencia del ecoturismo sobre la diversidad biológica? <input type="checkbox"/> La biodiversidad disminuye <input type="checkbox"/> La biodiversidad seguirá siendo igual <input type="checkbox"/> La biodiversidad aumentará
22.	¿Cuál es su opinión sobre la influencia del ecoturismo sobre la comunidad? <input type="checkbox"/> Influencia positiva <input type="checkbox"/> Ninguna influencia <input type="checkbox"/> Influencia negativa
23.	A) ¿Le gustaría trabajar con ecoturismo? <input type="checkbox"/> Sí <input type="checkbox"/> No B) ¿Cuánto debería ganar con el ecoturismo para que sea interesante para usted? <input type="checkbox"/> Menos que la actualidad <input type="checkbox"/> Lo mismo como la actualidad <input type="checkbox"/> Más que la actualidad
24.	¿Desde los siguientes puntos de vista (financiero, social, político, de gestión) cree usted que es posible la aplicación del ecoturismo? Financiero <input type="checkbox"/> Sí <input type="checkbox"/> No Social (¿Se ajusta a las normas de la comunidad?) <input type="checkbox"/> Sí <input type="checkbox"/> No, porque..... Político (¿Está permitido por la ley?) <input type="checkbox"/> Sí <input type="checkbox"/> No De gestión (¿Es posible en las condiciones actuales: Eres el dueño de la tierra, el conocimiento, la capacidad?) <input type="checkbox"/> Sí <input type="checkbox"/> No, porque.....
SOLUCIONES	
25.	¿Usted conoce otra solución para adaptarse al cambio climático? <input type="checkbox"/> No <input type="checkbox"/> Sí, (Completar lo que usted piensa que sea la solución).....

Muchas gracias por completar esta encuesta. Es de gran valor para nuestra investigación.

Jelleke & Saskia

