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Patterns of sustainable agriculture adoption/non-adoption in Panamá

**A thesis submitted to McGill University in partial fulfillment of the requirements of the
degree of Masters of Science in Agriculture and Biosystems Engineering with a
concentration in Neo-tropical Environmental Options**

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McGill University, Montreal
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ABSTRACT

The promoter system of agriculture extension has been widely studied and accepted as a tool for agriculture development where local resources are scarce. Much development work has been done in Panama using the promoter model. In order to ascertain the local success of this model, promoters trained by World Vision were visited. The adoption of sustainable agriculture practices were measured in five communities where 7 promoters were trained and placed in Veraguas, Panamá. Despite the long-term presence of World Vision and trained promoters, only six farmers have adopted at least one sustainable agriculture technique as a result of these extension efforts. Low adoption rates do not necessarily indicate project failure, but does indicate several barriers. These barriers are explored as well as reasons farmers gave for land use. Reasons for S/A use are also explored. Finally, recommendations for improving extension methods and future research are made.

RÉSUMÉ

Étudiée et acceptée de par le monde, la vulgarisation agricole par producteur-promoteur est un important outil de développement agricole là où les ressources sont limitées. Au Panama, un grand nombre de projets de développement ont suivi un tel modèle. Afin d'évaluer le succès de ce modèle à l'échelle locale, des producteurs-promoteurs formés par World Vision furent visités. À Veraguas, Panama, l'adoption de pratiques agricoles durables fut évaluée dans cinq communautés, là où 7 promoteurs furent formés et affectés. Malgré la présence à long terme de World Vision et des promoteurs qu'ils ont formé, ces efforts de vulgarisation n'ont abouti que chez six producteurs en l'adoption d'au moins une mesure de production agricole durable. Ce piètre taux d'adoption n'est pas nécessairement indicatif de l'échec global du projet, mais indique l'existence de plusieurs obstacles. En un premier temps, ceux-ci furent étudiés, puis la justification des choix d'aménagement des terres par les producteurs, particulièrement lors de l'adoption des mesures d'agriculture durables, furent également étudiés. En dernier lieu, des recommandations d'améliorations aux méthodes de vulgarisation et pour les études à suivre sont présentées.

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ACRONOYMS USED IN THIS PAPER

IDEAS:	Former world vision, NGO that works in agriculture development
MIDA:	Panama ministry of agriculture
NGO:	Non-governmental agency
S/A:	Sustainable Agriculture
S/B:	Slash and Burn Agriculture

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1.0 INTRODUCTION AND OBJECTIVES

Numerous studies abound in the literature about the successes and failures of sustainable agriculture (S/A) in the developing world (Ashby, *et al.*, 1996; Buckles, *et al.*, 1998; Faminow and Klein, 2000; Mak, 2001; Franzel *et al.*, 2001). Many studies describe techniques agencies should use for agriculture development (Bunch, 1982; Norman *et al.*, 1988; Bunch, 1990; Ashby *et al.*, 1996; Bunch, 1997; Deugd *et al.*, 1998; Fischer, 1998; Versteeg *et al.*, 1998; Place and Dewees, 1999; Faminow and Klein, 2000; Nasr in Reij and Waters-Bayer, 2001). Others describe characteristics that adopting or non-S/A adopting farmers have in common (Kebede *et al.*, 1990; Barbier, 1998; Buckles *et al.*, 1998; Buckles and Triomphe, 1999; Franzel *et al.* 2001; Lapar and Pandey, 1999; Nasr *et al.*, Nielsen; and Reij and Waters-Bayer; in Reij and Waters-Bayer, 2001; Bannister and Nair, 2003; Thangata and Alvalapati, 2003, Pattanayak *et al.*, 2003). These studies have contributed to a greater understanding of sustainable agriculture in the developing world. Most importantly, these studies have provided the backdrop of techniques that agencies world-wide use to meet the food needs of a growing population.

While these contributions have been valuable, they are a conglomerate of experiences from many different environmental, social, political, economical and cultural conditions. Nevertheless, local development agencies must work to meet the growing food needs of their respective populations. They meet these needs through applying findings from these studies to their own context. As a result, they may run into many country specific barriers that slow or prevent the success demonstrated in other countries. In order to overcome these potential hazards to successful agriculture development, focused research that takes into account country specific barriers needs to take place.

In order to overcome these potential hazards to successful agriculture development, focused research that takes into account country specific barriers needs to take place.

Panamá is no stranger to this situation. Many agencies are investing countless hours and funds training farmers in Panamá on sustainable agriculture techniques as an alternative to slash and burn agriculture. Unfortunately, few of these agencies have the personal and funding to investigate the long-term successes and/or failures of their efforts. Also, there are few studies in the primary literature that have investigated the environment in which farmers are making decisions about techniques that will be applied in their farms (Camara-Cabrales, 1999; Fischer and Vasseur, 2000; Fischer and Vasseur, 2002). This leaves a gap in information between theory and practicability that should be addressed. This information can be a valuable tool to local agencies as they develop and implement strategies aimed at implementing sustainable agriculture techniques in Panamá.

This study aims to build upon the framework begun in the aforementioned studies in order to fill this gap. The study investigates the suggestion by Fischer (1998) and Fischer and Vasseur (2002) that trained promoters can be used to implement sustainable agriculture techniques. These promoters can help alleviate overworked and understaffed agencies. They do this by teaching sustainable agriculture techniques to their respective communities and fellow farmers. Due to the fact that the promoter or farmer to farmer system is an oft-cited success story world-wide (Bunch, 1982; Bunch, 1990; Bunch, 1997; Buckles *et al.* 1998; Reij and Waters-Bayer, 2001), this study assesses the state of this system in Panamá. Based on an extensive literature review, personal interviews and experience, the following objectives were developed. These objectives were developed

with the goal of confirming and adding to the information existing in the literature in order to aide agencies and researchers in focusing their extension and research efforts.

The objectives of this study are:

- 1) Review the promoter system as a tool for sustainable agriculture extension in this area
- 2) Describe patterns of and reasons for slash and burn and sustainable agriculture use in the district of La Mesa in Veraguas
- 3) Describe barriers preventing the adoption of sustainable agriculture
- 4) Describe benefits/costs of sustainable agriculture adoption
- 5) Provide recommendations for improving agency approaches towards agriculture development and future research goals

The thesis is organized as follows. Chapter two will review the methodology used to study sustainable agriculture. Adopters of sustainable agriculture and techniques used for conducting research of these systems will be discussed. This literature review also provides the basis for the study and research methods used. Chapter three describes the methods used. Chapter four will present the results, while chapter five will discuss these results. Finally, chapter six will review the objectives while providing final conclusions and recommendations for future work.

CHAPTER 2: METHODS USED TO STUDY SUSTAINABLE AGRICULTURE

2.1 INTRODUCTION:

Many development agencies have invested a large amount of time and monetary resources into training farmers in sustainable agriculture techniques. Despite this large investment, research is only just starting to surface which addresses the need to assess the success or failure of these projects. Much of this research has focused on understanding what motivates farmers to innovate and introduce new agriculture techniques into their traditional systems. The following review will investigate the body of literature describing the techniques that researchers used in order to assess farmer acceptance of introduced innovation, the characteristics of adopters and non-adopters, agency styles towards innovation and promotion and finally a description of the farmer to farmer method for agriculture extension.

2.1.1 Background on Literature Reviewed

One important point to discuss before reviewing techniques researchers use is the nature of this literature. The literature reviewed for this paper came from studies that took place in Africa, Asia and Central and South America (Ashby *et al.*, 1996; Buckles, *et al.*, 1998; Faminow and Klein, 2000; Mak, 2001; Franzel *et al.*, 2001; and Fischer and Vasseur, 2002). While this is important as it advances knowledge on a global scale, many of these techniques are not locally tested. This is to say, that although there are successful projects in Honduras, these results may not be extrapolated to Panamanian farmers. As a result, the success of a local project may be limited due to site-specific factors not covered by the global literature.

Despite the apparent lack of primary literature, there are numerous grey (non-peer reviewed) literature articles available on local initiatives for researchers to work with. This can be an important starting point for researchers in project development. A paper by Buckles and Triomphe (1999) is a key example that integrating grey literature into their research can lead to beneficial results. In this thesis, almost 50% of the articles cited were from grey literature. This suggests that scientists are integrating grey literature in their studies in order to legitimize techniques put forth in non-peer reviewed papers (Buckles *et al.*, 1998; Buckles and Triomphe, 1999; and Fischer and Vasseur, 2002).

2.1.2 Definitions

Before unleashing this review, some guidelines concerning linguistics will be established. The literature abounds with attempts to define what sustainable agriculture (S/A) implies. Although numerous pages could be dedicated to discussing a definition, a general consensus is that an exact definition is not necessary in order to pursue research objectives (Pannell and Schilizzi, 1999; Buch-Hansen, 2001; Nair, 2001). Due to the myriad of techniques and facets that make up S/A, pursuit of a definition may be in vain (Pannell and Schilizzi, 1999). With that in mind, this paper will not utilize an exact definition of sustainable agriculture. Instead, when the term sustainable agriculture is used, it will be in reference to the perceptions of NGO workers and farmers of what is sustainable agriculture in Panamá. Likewise, when the term innovation is used in this thesis, it will be referring to any modification to traditional techniques used by Panamanian farmers. This is consistent with guidelines set forth by Reij and Waters-Bayer (2001). Moreover, these guidelines will be consistent with suggestions made by

Pannell and Schilizzi (1999) that research should focus on what aspects of sustainability are important both the researchers and stakeholders and to develop those aspects.

In the Panamanian context, sustainable agriculture is most often referred to as techniques that are not associated with traditional slash and burn agriculture (Gutierrez, pers. comm.). The techniques/innovations considered sustainable in the context of this study are: aquatic rice farming, soil conservation for hillside farming, using green manures and leguminous cover crops, fruit tree grafting, composting and timber plantations. Agroforestry will also be included under this umbrella.

2.2 HOW TO STUDY INNOVATION:

In developed countries, long term case studies carried out on experimental farms can be a valuable tool to track the success of innovation acceptance. In developing countries this is not such an easy task. Lack of infrastructure, politically appointed government workers, and poor communication between development agencies and researchers all make it difficult to get reliable information about an area before, during and after the introduction of any new agriculture technology.

Approaching the farmers themselves also can be a daunting task. Many farmers are illiterate, generally mistrusting of outsiders, and have no access to mail delivery, which make written surveys that farmers may fill out virtually useless (Fischer, 1998; Fischer and Vasseur, 2002). Researchers must physically go to each community and visit with farmers. This is a task that is no small feat due to poor roads, out of the way places and lack of reliable transportation (Fischer, 1998). As a result, ingenuity is needed in order to obtain the information necessary for the scope of a study. The following sections discuss tools that are being used to gather information about innovative farmers.

2.2.1 Research Tools for Working with Developing World Farmers:

Obtaining a pre and post innovation history is crucial to understanding how the impacts of the new techniques are over the previous ones. Also, this is important to understand the thought process behind innovation and adoption. This information can be useful for training programs that development agencies employ. In order to obtain this information, several tools are available to researchers.

2.2.1.1 Oral history

Oral histories, also known as chronosequences (Buckles *et al.*, 1998), take the place of long-term case studies when the latter are logistically impossible. Although scientifically imperfect, oral histories may be the best way to understand the socio-economic and physical environment into which a new technique was integrated. This technique can provide a pre and post crop history surrounding the introduction of a new technology. It can also provide a time line of agricultural activity in the community.

Despite their usefulness, care must be taken in order to ensure accurate results derived from chronosequences. This is due to the fact that information provided by farmers is subjective and may be inaccurate or difficult to verify. In order to be able to make accurate inferences about chronosequences, a large sample size is required (Buckles *et al.*, 1998, Fischer, 1998; Fischer and Vasseur, 2002). Performing an additional chronosequence at the end of the study can help to cross check information provided in the first chronosequence.

2.2.1.2 Semi-structured interview:

Several authors advocate using a semi-structured or ladder interview when working with developing world farmers (Loevinsohn *et al.*, 1994; Fischer, 1998; Lapar

and Pandey, 1999; and Fischer and Vasseur, 2002). This tool takes the place of a formal survey that is traditionally mailed out to farmers. The semi-structured interview requires that the researcher travel to the farmer's fields and conduct an oral interview using open-ended questions. The structure of the interviews allows the farmer to elaborate on their responses as opposed to one word answers. The free association style of the interview can overcome the problem of farmers telling the researchers what they want to hear, a common issue cited in the literature (Fischer, 1998; Fischer and Vasseur, 2002).

The literature suggests that these interviews be conducted at the farmers' fields (Buckles *et al.*, 1998; Fischer, 1998; and Fischer and Vasseur, 2002). This helps the researcher to verify the answers that the farmer gives concerning techniques utilized. It can also provide a basis for conversation such that the farmer may be more at ease and more able to share information about the farm. Finally, conducting an oral interview adjusts for the fact that many farmers may be illiterate. This avoids a culturally embarrassing moment for the researcher and farmer (Fischer, 1998).

2.2.1.3 Snowball sampling:

Another useful tool for following the chain of innovation adoption is the snowball sampling technique (Grisley, 1994; Fischer, 1998; and Fischer and Vasseur, 2002). The snowball sampling technique is as follows. After initial interviews with chosen farmers, the researcher asks about other farmers utilizing similar techniques. The researcher then finds and interviews these farmers. Snowball sampling is useful for a couple of reasons. One is that the researcher can determine if reasons for innovating and adoption are similar among the farmers who chose to integrate new technology into their farming systems (Fischer, 1998). Snowball sampling can also adjust for insufficient data about

participants in development programs (Fischer, 1998), as many programs keep poor and inaccurate written records of project participants. It can act as a verification tool in order to assure the accuracy of farmer and extension workers' estimations of farmers utilizing innovative agriculture techniques. Finally, snowball sampling can integrate a degree of randomness in studies that focus on identifying innovators prior to the interview.

2.2.2 Summary:

Several research techniques are available in order to adjust for the added challenge of research in developing countries. These techniques are summarized in Table 1. Relying on oral histories, semi-structured interviews and snowball sampling can be effective for obtaining information surrounding the decision making process farmers go through in their on-farm planning. These techniques can be useful in overcoming limitations due to the difficult research conditions inherent to developing countries. They can also provide useful baseline data that can be provide the basis for future studies (Buckles *et al.*, 1998; Fischer, 1998; and Fischer and Vasseur, 2002).

Table 1: Summary of techniques to study innovation acceptance

<u>Tool</u>	<u>How Applied</u>	<u>Advantage</u>	<u>Disadvantages</u>
Oral History	Interview farmers to get a history of technique utilization	<ul style="list-style-type: none"> -Takes place of a case study and can provide pre and post-innovation history -Allows for integration of indigenous knowledge -Understand reasons for innovation 	<ul style="list-style-type: none"> -Data can be unreliable -Difficult to verify results -Have to overcome participant bias
Semi-Structured or Ladder Interview	<p>Done orally in farms fields</p> <p>Series of questions that build on each other depending on farmers answers</p>	<ul style="list-style-type: none"> -Allows for elaboration on answers -Overcomes low literacy rates -Allows farmers to feel 	<ul style="list-style-type: none"> -Inconsistency in questions as they may vary from farm to farm

		<p>more at ease</p> <p>during</p> <p>interview</p> <p>process</p> <p>-Allows for</p> <p>verification of</p> <p>farmers</p> <p>answers</p>	
<p>Snowball</p> <p>Sampling</p>	<p>After interview,</p> <p>ask farmer who</p> <p>else utilizes</p> <p>similar</p> <p>techniques and</p> <p>follow the</p> <p>chain of</p> <p>innovation</p>	<p>-Helps to</p> <p>determine how</p> <p>wide spread</p> <p>innovation is</p> <p>-Can help to</p> <p>understand</p> <p>reasons why</p> <p>farmer adopt</p> <p>new techniques</p> <p>-Can adjust for</p> <p>insufficient data</p> <p>about farmers</p> <p>from</p> <p>development</p>	<p>-Will not have</p> <p>consistent</p> <p>numbers from</p> <p>town to town</p> <p>-Not</p> <p>completely</p> <p>random</p>

		agencies -Verification tool -Introduces randomness to a study	
--	--	--	--

2.3 CAPTURING THE “WHY” OF ADOPTION

Within the literature, there exists some debate about what is considered a successful adoption of new technology. Is just adoption good enough? One study by Martin and Sherington (1997) suggests that this is so, even going to the point of saying that classical statistical analysis is unnecessary. They go on to state that “farmer adoption of these techniques should be sufficient evidence of the success of the project” (Martin and Sherington, 1997).

Although Martin and Sherington (1997) bring up a good point, several authors expand on this by saying that a good measure of success is widespread replication among farmers without them receiving any incentives such as subsidies or food for participation (Faminow and Klein., 2000; Fischer, 1998; Franzel *et al.*, 2001; and Fischer and Vasseur, 2002). But repetition is not the only factor that researchers should be looking for. The following section will be looking at multi-discipline, farmer livelihood choice, reasons for adoption and characteristics of adopters and non-adopters as factors that are to be considered in innovation acceptance. This is done keeping in mind that if understanding innovation acceptance is going to be helpful to develop better farmer training programs,

then studies must not only look at how many farmers are innovating and adopting, but *why*?

2.3.1 Multi-Discipline Factors

Understanding the why of adoption begins with taking into account the various multidiscipline factors that can influence a farmer's agricultural decisions. The success of newly introduced techniques into a farming community is dependent on many different factors crossing many disciplinary lines. New technology adoption by farmers occurs in the context of the social, economical, environmental and political context of the given area (Strauss *et al.*, 1991; Fischer, 1998; and Fischer and Vasseur, 2002).

To capture this atmosphere, many studies consist of multi-discipline research teams (Loevinsohn *et al.*, 1994; Ashby *et al.*, 1996; Buckles *et al.*, 1998; Faminow and Klein, 2000; and Franzel *et al.*, 2001). Although this is clearly advantageous, it is not always practical. Alternatively, it is possible for a single researcher to use a questionnaire that will attempt to capture all of the socio-economical, environmental and political factors that influence farmer decisions (Fischer, 1998 and Fischer and Vasseur, 2002). Interviewing development workers can also provide insight to adoption patterns (Fischer, 1998; Lapar and Panadey, 1999; and Fischer and Vasseur, 2002).

2.3.2 Farmer Livelihood Choice

The type of farmer may also influence whether or not the farmer adopts new technology. A study by Buckles *et al.* (1998) used categories of farmer livelihood choices to determine the group most likely to adopt improved agriculture technology. These categories were: ranchers, diversified farmers, medium-scale farmers, small-scale farmers and subsistence workers. From this information they were able to develop a

composite of the typical farmer who would likely adopt improved agriculture techniques. The study found that subsistence farmers were least likely to adopt new technology, while medium-scale farmers and established ranchers were most likely to adopt new technology. Buckles *et al.* (1998) argues this success is due to the better financial situation of the medium-scale and ranchers. This information can be helpful to development agencies for targeting their efforts.

2.3.3 Reasoning for Adoption

The reasons that farmers give for adoption can be useful to scientists and development agencies. Buckles *et al.* (1998) required farmers in their study to rank reasons commonly given for the inclusion of *mucuna* into their farming systems. The most popular answer given was the fertilizer effect of *mucuna*, followed closely by the reduced labor for land preparation and moisture conservation. These answers can provide useful information about the mindset the farmer has while planning farm activities. With this information, extension and development agencies can adjust their training programs in order to more effectively “sell” techniques to farmers.

2.3.3.1 Who are the adopters?

Knowing characteristics of adopters can help researchers formulate effective questionnaires that capture the reasons for adoption and to interpret results. The literature highlights several characteristics that adopters have in common. This is a reflection of a myriad of socioeconomic conditions which influence farmer’s decisions in adopting innovations. The following section reviews the literature and highlights some of the main characteristics of adopters.

Land ownership plays a major role in adoption of innovations. A farmer who owns his own land will more likely integrate sustainable agriculture innovations (Buckles *et al.* 1998; Buckles and Triomphe, 1999; Lapar and Pandey, 1999; Bannister and Nair, 2003; Pattanayak *et al.*, 2003). This is obvious as a farmer renting land has no long-term relationship with the land, therefore has little incentive for improving upon the conditions of the land. Related to land ownership is a farmer's wealth. According to the literature reviewed, wealthier farmers were more likely to integrate S/A innovations into their farms (Kebede *et al.*, 1990; Franzel, *et al.* 2001; Reij and Waters-Bayer in Reij and Waters-Bayer, 2001; Pattanayak *et al.*, 2003). Wealthier farmers tend to have less risk aversion and more room for error than poorer farmers. Therefore they are more open for experimentation and acceptance of new techniques. Along the same lines, better educated farmers are more likely to adopt innovation (Strauss *et al.*, 1991; Lapar and Pandey, 1999; Nasr *et al.* in Reij and Waters-Bayer, 2001; Bannister and Nair, 2003).

Another factor influencing adoption is age of the farmers. There exists some debate as to what is the ideal age for innovation. Some studies suggest that older farmers and therefore more experienced farmers (over thirty) are more likely to adopt sustainable agriculture (Kebede *et al.*, 1990; Reij and Waters-Bayer, Nasr *et al.*, Nielsen, in Reij and Waters-Bayer 2001; Bannister and Nair, 2003). Other studies suggest that younger farmers (under 30) were more likely to adopt (Lapar and Pandey, 1999; Thangata and Alvalapati, 2003, Gutierrez pers. comm.). This contradiction could be influenced by the wide geographic and cultural distribution of the studies. This stresses the need for localized studies that can highlight site specific factors that will be more meaningful to local institutions.

Finally, population pressures influence adoption. More densely populated areas place higher pressures on the land, making once sustainable techniques unsustainable. This forces farmers to adapt their techniques in order to meet food needs (Barbier, 1998; Franzel, *et al.*, 2001; Lapar and Pandey, 1999; Reij and Waters-Bayer in Reij and Waters-Bayer, 2001).

Combining all of the above factors, one can deduce that the ideal adopter owns land, is comparatively wealthier, better educated, and faces population pressures to incorporate change into his farm. Generally speaking, farmers who have these characteristics, generally have less risk aversion, therefore they are able to try new techniques. The literature supports this observation, as farmers who are risk adverse are farmers less likely to adopt new techniques (Kebede *et al.*, 1990; Franzel *et al.*, 2001; Bannister and Nair, 2003; Pattanayak *et al.* 2003).

2.3.4 Including Non-Adopters

While interviewing adopting farmers is useful, non-adopters can also be a valuable source of information. They can highlight barriers that are in place that hinder more widespread adoption of new agriculture techniques (Buckles *et al.*, 1998; Fischer, 1998; and Lapar and Pandey, 1999). In addition to interviewing adopters and innovators, some researchers have focused their interviewing to non-adopters whose fields shared boundaries with adopters (Buckles *et al.*, 1998 and Lapar and Pandey, 1999). There are a couple of reasons for this shared border approach. One was to understand the reasons why some farmers did not adopt new agriculture techniques. The other was to avoid possible confounds such as fields that exist in differing soil, landscape or water conditions that can influence new technology adoption.

2.3.4.1 Non-adopters and slash and burn agriculture

For the purpose of this thesis, farmers who continue to rely on S/B are considered to be non-adopters (Fischer, 1998). From a Panamanian perspective, non-adopters tend to rely heavily on slash and burn or shifting agriculture techniques (Gutierrez, pers. comm.; Fischer, 1998, Fischer and Vasseur 2000). Slash and burn agriculture has been practiced in Panamá since 5000 B.C. (Fischer, 1998; Fischer and Vasseur, 2000). It has been practiced globally for thousands of years as well. Slash and burn agriculture has been sustainable during times when high yields were not necessary to feed a booming population (Harwood, 1996; Mertz, 2002). It is only until recently that S/B practices have become unsustainable and need for innovative practices have arisen (Mertz, 2002).

The general S/B practice goes as follows in Panama: Farmers first clear cut a swath of land in early March, the last month of the dry season. Once cleared, they leave the cuttings to dry out for a couple of days, then burn the dying organic material (Harwood, 1996; Gutierrez, Heckadon pers. comm.). Farmers believe that the burning is what gives the soil its “power” (translation mine) that results in high harvests the year following the first burn. Harvests generally diminish over the next couple of years, however. After about five years of using this land in ideal conditions, the land is left to fallow. Under low population density, the required fallow period should span 8 to 20 years is possible (Fischer, 1998, Mertz, 2002; Gutierrez pers. comm.). Long fallow times allow soil to regenerate, making this system sustainable (Mertz, 2002). The system becomes unsustainable when population pressures force farmers to reduce fallow times. The reduced fallow times do not allow for natural soil regeneration. As a result, harvests diminish, and farmers are forced to look for alternatives to slash and burn agriculture.

2.3.5 Agency Approaches

How the agency works with the farmer may influence innovation adoption.

Probably the most important factor is understanding the environment in which the farmer works. Therefore the appropriateness of the technology introduced is key to successful adoption (Franzel *et al.*, 2001; Neupane *et al.*, 2002 ;). In order to ensure that the technology is appropriate, farmers should be included in the early stages of project planning (Norman *et al.*, 1988; Bunch, 1990; Ashby *et al.*, 1996; Bunch, 1997; Deugd *et al.*, 1998; Fischer, 1998; Versteeg *et al.*, 1998; Place and Dewees, 1999; Faminow and Klein, 2000; Nasr in Reij and Waters-Bayer, 2001). This way, agencies and scientists can ensure that the farmers will be more accepting of the new technology. One way to ensure this is to augment upon traditional practices so as not to introduce a radical change (Messerschmidt, 1988; Martin and Sherington, 1997; Faminow and Klein, 2000). Too radical of a change forces farmers to take a big gamble on unproven techniques. As discussed earlier, poor farmers are less likely to take on a large amount of risk. Therefore, agencies must take care in developing simpler techniques that can easily be integrated into a farmer's traditional practices (Bunch, 1982, Bunch, 1990; Bunch, 1997; Fischer, 1998).

Despite these suggestions, observations have shown that agencies often fail to take farmer's input into account in the planning and implementation of S/A projects (Martin and Sherington, 1997; Fischer, 1998; Fischer and Vasseur, 2002; Bannister and Nair, 2003). This failure may be the reason that so many projects tend to be unsuccessful in integrating S/A techniques with traditional rural systems (Deugd *et al.*, 1998; Fischer, 1998; Pattanayak *et al.*, 2003).

2.3.6 Summary:

In order for research on farmer innovation adoption to be successful, it needs to capture why farmers are adopting or not adopting new technology. In order to do this, research needs to be multi-disciplinary by either using multi-discipline teams or by using questionnaires that capture multi-discipline factors. Also, identifying and categorizing farmer livelihood choices can help develop a composite of the type of farmer more likely to adopt new agriculture technology. In addition, determining popular reasons that farmers give for adoption of certain agriculture techniques can help development agencies design training programs focused towards these reasons. Using findings from the literature that describe general characteristics of adopters can be helpful in study design as well. Including non-adopters and understanding the characteristics of their behaviors in surveys can help researchers understand the reasons for non-adoption of new agriculture techniques. Finally, understanding how agencies work with farmers can shed light on the adoption or non-adoption of techniques.

2.4 EXTENSION STYLES: TOP DOWN VS. FARMER TO FARMER

There are several techniques that can aid in the integration of S/A techniques in rural communities. This section will investigate two approaches: Top-down and Farmer to Farmer. Top-down extension is where scientists and extension agents dictate new technologies to farmers. This often occurs without any input from the farmers' point of view and has been the traditional method used by many agencies. Due to the lack of farmer input, the top-down technology transfer approach has been waning in recent years (Fischer, 1998; Witcombe, 1999; Neupane *et al.*, 2002; Bannister and Nair, 2003). This has created a need for other methods for information dissemination to farmers. There has

been an increasing body of literature echoing the sentiments of farmer inclusion that has noted the importance of farmer to farmer technology transfer. This system that relies on local promoters has been noted to be fairly successful (Bunch, 1982; Ashby *et al.*, 1996, Fischer, 1998; Buckles and Triomphe, 1999; Fischer and Vasseur, 2002). This success could be due to farmers becoming experts themselves due to experience gained from their own farms (Deugd *et al.*, 1998). These farmers have a more realistic view of these techniques and can relate better with their peers compared with extension agents and scientists. This success warrants more discussion as it is this system that is the basis for this study.

2.4.1 Who are Promoters?

Promoters are farmers with little to no formal education, community leaders who are serious and dedicated to their work and have extensive experience in training and farming (Bunch, 1982; Bunch 1990; Bunch, 1997; Selener *et al.*, 1997). These authors further comment that for promoters to be successful, they need to be respected leaders in their communities. They also point out that extension training can compliment the leadership skills of the farmers. This allows the promoter to act effectively as extensionalists, especially where trained experts are scarce. Promoters can also act as a liaison for the community, government agencies and scientists due to their leadership positions. They generally work within their communities and neighboring communities training their neighbors in S/A techniques. They do this through demonstration plots where they apply techniques learned in a variety of training sessions. They provide an important service as their ability to relate with their neighbors can actually aid in the spread of a new technology.

How promoters are trained and train other farmers varies dependent on location. In Honduras, conflicting results highlight this variance. Buckles (1998) reports that it has taken up to ten years for the extension to become widespread. Contrasting this observation, Bunch (1990) and Neill and Lee (1999) report this extension to take place spontaneously and without outside intervention. Research in Uganda quantifies the success of this system. Miiro *et al.* in Reij and Waters-Bayer (2001) tracked 32 original innovators and found that from these 32 farmers, over 1500 new farmers adopted techniques through first and second generation adopters.

Based on these studies, the promoter model of agriculture extension represents great potential as a tool for agriculture development. While it represents a valuable tool, the debate about the speed of extension warrants site-specific research.

2.4.2 Summary

Top-down extension, due to little farmer input in the project development process, has had limited success as a model for agriculture development. As a result, methods incorporating farmer input have arisen. One model, the farmer to farmer or promoter model has demonstrated measurable success in various countries in the developing world. Taking advantage of leading farmers based in numerous communities, agencies can reach more farmers and communities where trained experts are scarce. Site-specific research will highlight localized strengths and weaknesses of this model of development.

2.5 CONCLUSIONS:

The literature suggests that research in developing countries should generally utilize techniques such as chronosequences, semi-structured questionnaires and snowball sampling techniques that capture the multi-discipline environment of farmer decision

making. This provides a general framework from which to conduct site-specific research. Despite a general framework to follow, the literature is from several regionally distinct locations, and may not apply to specific cases in specific countries. There needs to be a larger database of local information from which to develop conclusions about local processes. The lack of abundant localized studies, especially in a Panamanian context, indicates a hole in the research literature that generally describes a movement away from top-down extension towards grass roots, farmer to farmer extension with a greater cooperation between researchers, extension agents and farmers.

In order for this movement to be successful, there needs to be a wave of site-specific primary research whose results can facilitate grass root education in developing countries. Site-specific research should integrate the framework discussed above. This way site-specific research can verify the results of these previous regional studies. These site specific studies should also build on previous studies (grey or primary) completed in the region in order to build on the institutional knowledge that exists in a specific area. These site-specific studies can then help local agencies adjust their training programs in order to help farmers become more successful in integrating new agriculture techniques with traditional ones. This will not only serve the purpose of increasing the body of knowledge about this specific issue, but can also allow science to act as a tool for development.

CHAPTER 3 METHODOLOGY USED

3.1 STUDY AREA

For a detailed description of the country of Panamá please refer to Fischer, 1998. The study was conducted in five communities in the judicial district of La Mesa in the province of Veraguas, Panamá. Please see Appendix B for a map of Panamá and Veraguas. According to the Direccion de Estadistica y Censo of Panamá 2002 data, Veraguas has the following characteristics. Veraguas is located between 7 degrees 12'07" and 8 degrees 36'43"N and 80 degrees 36'43" and 81 degrees 53'43" longitude west. Veraguas has the third largest land area of the nine provinces of Panamá with 11,239.4 Km². Veraguas has eleven districts and a total of 77 townships. The temperature of Veraguas ranges from 22 to 27 degrees Celsius, and has an average rainfall of 2,000 and 5,000 mm/yr depending on the area of the province. The majority of the economy of the province comes from agriculture with rice and corn being the major crops. In addition to agriculture, sugar cane plantations provide employment to the subsistence farmers in the summer months. Compared with the rest of the country, Veraguas is the third most economically productive province. According to 2001 census data (the most recent census), Veraguas has a population of 209,076 representing a 5% decrease compared to 1996 census figures. Most migration is a result of people moving into Panamá City and the Darien looking for work and/or land. This decrease in population is reflected by an overall decrease in farming as Veraguas has a 4.4% decrease in agricultural activities compared to census data from 1991. It was reported in the 2001 Census that Veraguas has 33,356 farms, of which 27,354 are larger than .10 ha.

Due to time and travel constraints, it was decided to focus on only the towns that IDEAS¹ had worked with in the district of La Mesa in the province of Veraguas. La Mesa has a surface area of 515.7 Km², the eighth largest of 11 districts and has a population of 11,746 according to 2001 census data, which is a decrease of 9% compared to census data of 1996 and the seventh most populated of the 11 districts. Census data of 2001 reported that La Mesa has 2,676 farms of which 2,190 are larger than .10 ha. This represents a 4.1% increase in farms compared to 1991 census data. The communities visited were Altos de Los Sánchez, population of 450, El Cedral, (90), Las Valdezas, (160), Oja de Tenil (100), and Peñitas de Cobre (100). The towns were selected based on conversations with workers from the NGO IDEAS who had trained promoters in these communities. Out of these conversations, the workers were told the goals of the study, especially the fact that I was looking for a realistic representation of the successes and failures of their program, and they recommended visiting communities they had worked with in this area. Seven communities were visited in preliminary visits and five communities were selected for follow up visits for the study. Non-availability of the promoters was the main reason for not including the other two communities.

3.2 AGENCY OVERVIEW AND INTERVIEWS

Fischer (1998), Fischer and Vasseur (2000), and Fischer and Vasseur (2002) provide a detailed description of the Panamanian agricultural situation. They concluded that shifting agriculture has played a major role in deforestation of Panamá. They also conclude that introduction of agroforestry or sustainable techniques have been generally hampered due to top-down methodology, inappropriate technology and information

¹ IDEAS was formerly known as World Vision before funding ran out. It is located in Santiago, Veraguas in Panamá. Ing. Raul Gutierrez and Lic. Oliver Madrid were the contacts who worked with the author on this project. For more info, contact the author.

sharing, not including the farmers in the project designs and farmers unable to assume the risk of adopting new techniques. These studies suggest that to overcome these barriers, development should take advantage of a promoter system as outlined by Bunch² (1982, 1990 and 1997). Based on these recommendations, this study decided to focus on agencies that have been training promoters to determine if this is indeed a viable option for promotion of sustainable agriculture in Panamá. After conversations with several agencies, authors and development workers it was decided to focus on one agency: World Vision (now referred to as IDEAS), based in Veraguas.

3.2.1 World Vision Description

From 1990-1998, World Vision, with funding from World Vision International, worked in rural communities in order to improve the living conditions of the residents. World Vision International is a faith based organization whose goals are to eliminate poverty and hunger with a special focus on children. They receive funding primarily from donations where individual donars are asked to “adopt a child.” These funds are used to develop sustainable agriculture programs across the world, although they ceased to fund projects in Panamá in 1998. For more information consult their web page: www.worldvision.org.

When workers from World Vision first entered communities, they formed working groups. Through these groups, community assessments that helped communities identify needs were performed. Poor harvests and farming conditions were mentioned as a major problem many of these communities faced. In response to these needs, World Vision worked with communities to elect up to three farmers who would be trained in sustainable agriculture techniques. Beginning in 1994, World Vision brought 10-15

² Please see section 4.1 in the literature review for a detailed discussion of the promoter system

farmers per year to a central training farm whose conditions were similar to those farmers faced in their own communities. Here they met one week a month to participate in classroom and field exercises learning and practicing S/A techniques. Upon completion of this week, farmers were expected to go back to their communities and establish the techniques learned on demonstration plots. The training was for one year, with World Vision doing follow-up visits periodically until 1998, when the project lost funding. All told, about 90 farmers were trained in various communities throughout the Veraguas province. After 1998, World Vision changed its name to IDEAS, attempting to continue upon its projects, but were hampered by funding constraints. As a result, they were unable to continue with follow up visits to the communities in which they worked. Currently, they serve as consultants for agricultural development agencies across Panamá, having all but abandoned the initial communities of World Vision.

3.2.2 Agency Interviews

Extensive conversations were held with workers from the NGO IDEAS. These conversations followed a semi-structured interview format. The goal was to generate in-depth responses about their experiences in training promoters. Successes, failures, methods, goals, barriers to sustainable agriculture implementation, reasons for reliance on slash and burn agriculture, barriers for promoter development, and constraints they as an agency faced were all determined through these conversations. Examples of the questionnaire used can be found in Appendix A.

3.3 TOWN VISITS

Based on the literature discussed in the previous chapter and through conversations with workers from IDEAS, it was decided to do a preliminary visit to the

selected communities before entering the communities for the survey. The first visit was coordinated with IDEAS workers. The workers brought me to these communities to meet the promoters whom they had trained. A return date and sleeping arrangements for the return visit was arranged with these farmers. The objectives and goals of the study were explained to the farmers either by me or by the IDEAS workers. This first visit was necessary to gain confidence and trust which would aid in completing the survey. This became especially important in light of a rash of child kidnappings throughout Panamá which made communities suspect of outsiders. These surveys would have been impossible had I not been formally introduced to the leaders of these communities.

3.3.1 Second Visits

The second visits were confirmed and arranged one week before entrance to the community through phone calls and radio messages. This ensured that the community knew the researchers were arriving. Two researchers were used for the second visits, the author and a research assistant. For the communities of Las Valdezas and El Cedral, both researchers visited the towns. For the other towns, only one of the researchers visited. Researchers arrived by foot due to lack of local transportation to the communities. Walking times from the main highways ranged from five minutes to an hour and a half. Although use of a vehicle would have assisted in easing the logistics, it was felt by the researchers (based on previous experience) that by using the same methods that the locals use to arrive in their communities, the local farmers respected the researchers more and were more willing to share their experiences. This can also give the researcher an idea of how difficult it may be for the farmers to leave the community and for agencies to arrive.

3.4 INTERVIEWS

3.4.1 Participant Selection

For all interviews conducted, the objectives and goals of the study were discussed with participants before the interview began. The participants were then asked for oral consent according to ethical guidelines set by McGill University. Although the guidelines call for written consent, oral was deemed necessary due to possible embarrassing moments with illiterate farmers.

In all of the communities visited, first the main promoter was interviewed. After this interview, the promoter was asked about farmers they had taught, and then these farmers were interviewed. Finally, S/B farmers were interviewed. The promoters often accompanied the researchers during to the interviews in order to introduce the researcher to the farmer. Promoters also aided in facilitation of the interview. It was decided to attempt to interview as many of the farmers as possible in the time span that the researchers were in the communities. Due to time limitations, attempts were made to take advantage of community meetings or *juntas* (community working groups) to interview as many farmers as possible. Whenever it was possible interviews were done on the farms to avoid “tell me what I want to hear” responses and to verify techniques. This was especially important for the promoters or sustainable agriculture users. Farmers were categorized into two agriculture groups: “Sustainable Agriculture” (S/A) and “Slash and Burn Agriculture” (S/B). This is a modification of the methodology used by Buckles³ (1998) which suggested separating the farmers into several groups. Personal observations noted that there were only these two groups in the communities visited.

³ see section 3.2 of the literature review chapter of this paper

With the exception of two of these communities (Altos de Los Sanchez and Peñitas de Cobre) the amount of land the farmers owned varied. The two aforementioned communities had land collectives where all in the community had the same amount of land to farm. This resulted in farmers working individual plots of the same size.

Interviews used “snowball” sampling techniques which began with the community promoters, then spread to farmers with whom they had worked or trained. This method was only used in the case of S/A farmers. S/A farmers were classified as those who did not rely on S/B to prepare their land and used techniques outlined in 1.0.2 of the second chapter. All S/A farmers in each community were interviewed.

For the S/B farmers, researchers attempted to interview as many farmers as was possible in the three-day community stay. Constraints such as weather (where strong thunderstorms impeded travel) and early nightfall (due to lack of electricity) limited access to farmers. Women were included in the study only when they were active participants in crop field work. Only one person per household was interviewed, although some of the surveys were conducted with husband and wife, father and son, etc. In one instance, a group interview was conducted. Group results were not included in the data analysis, but are used for comparison in the discussion section to follow. Table 1.4 in the results chapter has a breakdown of participants per community.

3.4.2 Time Frame of Interviews

In two communities, Las Valdezas and El Cedral, two researchers stayed in the house of a promoter for three days. The other communities had only one researcher per community. Research was conducted during the middle of the week. The main reason for this was to take advantage of farmers being in their fields during the interview. Time

and budgetary constraints limited the amount of time the researchers could spend in each community, but it was determined that after three days the majority of farmers could be reached and interviewed. Interviews lasted from 10 minutes to an hour and a half. Interviews with S/A farmers generally took longer due to more questions and in-depth conversations about their methods and techniques. A list of the questions used can be found in Appendix A.

3.5 QUESTIONNAIRE

As mentioned earlier, please refer to Appendix A for a copy of question used in the study. The questionnaire used was developed over a two year process after careful consultation with the literature, development agencies and finally was put into practice with focus groups across Panamá in May of 2002. Questions were practiced with 20 farmers in several communities who had extensive experience with development agencies. Numerous communities from geographically diverse parts of Panamá were used in order to ensure that regional interpretations of the questions would be accounted for in the final questionnaire. Also, talking to a variety of farmers was done in order to determine which questions would be awkward, poorly worded, culturally insensitive or too complex for farmers to answer. Finally, using farmers with extensive experience working with agencies was done in order to ensure that farmers would be frank with their feedback. Often, farmers not familiar with outside agencies are shy and reserved (personal observation) in Panamá and tend not to offer constructive criticism in order not to offend the researcher.

A series of semi-structured interview questions were asked of each farmer in order to determine the situations faced in making management decisions. The semi-

structured format allowed for elaboration of answers and for follow-up questions to verify answers or to go further in-depth. Since the goal of the research was not only to gather information about farming systems, but to ascertain some idea of the more complex picture of the decision making process, the semi-structured format allowed for the necessary flexibility. Questions were asked orally in order to avoid embarrassing situations with potentially illiterate farmers. Interviews were carried out in Spanish, and no translations were used or necessary. The interviewers took notes during most of the interviews and followed a general format that asked questions regarding community data, farm data, socio-economic data and environmental data. S/A and S/B questionnaires are listed in Appendix A and differ only in the fact that the open-ended format allowed for more in-depth interviews of S/A farmers due to them incorporating more techniques into their farms and to determine where the technology was learned.

3.6 STATISTICS

Due to small sample sizes and recommendations from similar studies (Moretti, 2000 and Linton (in press), basic summary statistics analyzing percentage of responses recorded were used. Results are summarized graphically in figures 1.1 through 1.11 in the results chapter. These figures are presented in chronological order beginning with the most common response given. This analysis was used to determine the top responses given for use in future follow up studies as suggested by Buckles *et al.* (1998).

Answers to the questions were placed into categories listed in Table 1.1. Answers were qualitative thus had to be categorized and scored in order to quantify the data for analysis. Responses were assigned a percentage based on their frequency of occurrence and this data was used to determine trends in adoption practices.

In several but not all instances, more than one answer was given to a particular question. For example, when farmers were asked what barriers were in place that hindered adoption of S/A, a farmer may have mentioned that they do not own the land and that there is insufficient extension activity in their community. Generally, the literature has measured these answers per farmer, resulting in pooled results of more than 100% (Moretti, 2002). Since the objectives of this study are more focused on generating top responses for future studies, responses were counted against a pool of answers, not per farmer. For example, if ten farmers gave two responses each, I counted the responses on a scale of twenty and not ten. This was felt by the author to be a more realistic representation of the data according to the thesis' objectives.

Table 1.1: Categories and sub-categories used in data analysis

Category	Sub-category
Farmer Techniques	Sustainable agriculture or Slash and Burn
Slash and Burn Agriculture	Reasons for use, reasons for non-adoption of S/A, barriers to S/A use
Sustainable Agriculture	Reasons for use, techniques used, benefits, direct impacts on life
Environmental and Sociological	Harvest, rainfall, soil conditions, outside sources for income, age, education, family size
Agency relationships with farmers	How to improve relationships
Agency perceptions of working with farmers	none

CHAPTER 4: RESULTS

Table 1.1: Breakdown of participants in survey

Community	Population	S/A Farmers Interviewed		S/B Farmers Interviewed		% of population Interviewed
		Male	Female	Male	Female	
Altos de Los Sanchez	450	4		6		4.5
El Cedral	90	1		25*		29
Las Valdezas	160	2	1	6	4	12.3
Oja de Tenil	100	2	1	2	3	8
Peñitas de Cobre	100	2		3		5
Total	900	11	2	40	7	6.2

* including 19 interviewed in focus group

Table 1.2: Comparison of harvests conditions between S/A and S/B farmers over last ten years.

Farmer Style	% reporting improved harvests	% reporting decreased harvests	% combined data for improved harvests	% combined data for decreased harvests
Slash and Burn	6	31	31	31
Sustainable Agriculture	55	0		

Table 1.3: Comparison of harvest use between S/A and S/B farmers

Farmer Style	% Consumption	% Sell to neighbors or market
Slash and Burn	100	12
Sustainable Agriculture	100	33

4.1 SOME NOTES ABOUT THE DATA

The data presented below describes trends observed in this study. While inferential statistical conclusions are difficult to make given the small sample sizes, it should not take away from the validity of the observations. These are the very real reasons farmer gave as the basis of their decision making process. While the small data set does not allow for thorough statistical analysis, farmers continue to make these decisions. Likewise agencies continue to work with these farmers. The goal of this study was to provide agencies with a little more information to help them better serve the farmers. Another goal of this study was to gather information that the scientific community can build upon for future research. As mentioned in the literature review, precious few studies exist in Panamá to address these issues. It is the hope of the author

that this study is an important step towards more agriculture research in Panamá, especially since McGill is looking to expand upon its graduate program based in Panamá.

Finally, while the study included questions presented to the farmers to assess changes in the local environment, the author felt that there was too small a data set and the observations were too subjective to be of concrete value. Therefore this data is not discussed in our analysis⁴.

4.2 PARTICIPANTS AND FARM INFORMATION

Table 1.1 summarizes the breakdown of farmers interviewed per town. Thirteen sustainable (two female) agriculture farmers and 47 (seven female) slash and burn farmers for a total of 60 farmers were interviewed. Of the thirteen sustainable farmers, nine were trained promoters targeted initially for the study. Ages ranged from mid 20's to 70's. The farms ranged in size from .25 to 18 ha with an average size of 1.89 ha (standard deviation 3.012). All but two of the farmers owned the land they farmed. Distance to the farms ranged from next to the house to a thirty minute walk. Slash and burn farmers used the same piece of land for an average of 2.68 years (standard deviation 2.38) while S/A farmers used the same piece of land for an average of 7 years (standard deviation of 3.67). The observed average reflects time since they incorporated the S/A techniques into their farms. All of the S/A farmers were planning on using the same piece of land indefinitely. S/B farmers commented that they use the same piece of land depending on how long it would continue to produce.

⁴ The author would have liked to include the data in the appendix, but it was 75 pages of spreadsheet data, a CDROM copy will be available with main thesis

4.3 FARMER TECHNIQUES

One of the primary objectives of this study was to identify techniques farmers use to prepare and maintain their farms. According to survey results, there were two major styles farmers utilized. These were slash and burn and sustainable agriculture.

According to the results as shown in Fig. 1.1, the majority of farmers practiced S/B agriculture (75%). Farmers practicing sustainable agriculture techniques accounted for only 21% while 2% of the farmers interviewed utilized a mixture of the two styles and 2% did not farm. The mix of styles refers to farmers using S/A while still burning to prepare their land. An important factor to consider with these two farming styles is integration of change into their systems.

Farmers were asked if they had incorporated at least one change into their farms in the last five years. Results showed that 100% of S/A and 35% of S/B farmers responded that they had changed or modified at least one technique on their farm. These technique changes included using different planting styles or tools compared to how they approached agriculture before. For the survey, all types of change were considered. This will be discussed in the conclusion and recommendations chapter as opposed to the discussion chapter. This is because incorporating change into farms could be a valuable indicator to be used in future studies.

4.3.1 Slash and Burn Agriculture

4.3.1.1 Reasons for using S/B

Another objective of the research was to determine reasons farmers give for utilizing slash and burn agriculture. One of the questions asked slash and burn farmers why they use S/B techniques. These trends are shown in Fig. 1.2. "Tradition" was the

Figure 1.1 Farming Styles.

Figure 1.2 Why Use S/B

Why farmers use slash and burn agriculture techniques

strongest reason farmers give for using slash and burn agriculture (37%). “Personal preference” and that S/B is “easier” followed at 21%, while “land issues” (ownership, perceived inappropriate land for S/A) and S/B produces “higher immediate yields” came in third and fourth at 14% and 12% respectively. Other reasons given were “need to burn” at 5% and that S/B is “cheaper” (2%). There was an “other” category that included responses that did not fit into any of the previous categories. This included responses such as no comment, ignorance and planning to leave S/B. The “other” category made up 9% of the responses.

4.3.1.2 Reasons for non-adoption of S/A

Farmers practicing slash and burn agriculture were then asked to give reasons for why they did not use sustainable agriculture techniques. This was due to the fact that 98% of farmers surveyed had heard of S/A techniques, yet few had been practicing them. Trends are summarized in Fig 1.3. “Land issues” responses such as ownership or lack thereof of land, and perceived poor land conditions that did not warrant use of S/A accounted for 26% of the responses. The perceived poor land condition is an interesting point that will be developed in depth in the discussion section. The “other” category accounted for 22% of responses. This category contained numerous responses such as S/A techniques not working or no comment. Each of these responses had a score of one for frequency reported. Since they were not related to any of the other categories listed, they were placed in the “other” category. Due to the wide range of answers given, this category made up for the second most popular category. A larger sample size would probably establish stronger trends, either eliminating this category or lowering its percentage. “Lack of interest” made up 13% of the responses and “waiting for results of

Figure 1.3: Why S/B farmers do not use S/A

S/A farmers” and “too much work” made up 9% of the responses each. Other reasons given were “requires too much time,” “slow results” and “lack of money” (6% each) followed by “illness” with 3%.

4.3.1.3 Barriers to integration of S/A

These results were further explored by asking farmers what barriers exist to prevent them from integrating S/A techniques into their own farms. This question was asked as well to farmers practicing S/A. The trends observed yielded no differences between groups in the top four responses; therefore the results were combined and presented in Fig. 1.4. Still, it would be interesting to look at these groups separately with a larger sample size. Again there were a wide range of results, making concrete conclusions difficult. A larger sample size could establish stronger trends. Sustainable agriculture being “too much work” was the top response at 16%, while “too expensive” accounted for 14%, “land issues (ownership, inadequate land),” and “lack of and improper equipment” each accounted for 13%. “time conflicts” (11%), “lack of technical support” (6%), “other (illness, lack of knowledge)” (6%), “slow results” (5%), “not interested” (5%) and “migration” (5%), “lack of follow up”(3%), and “alcohol use” (3%) were the other responses given by farmers in the survey. “Alcohol use” pertained to comments by farmers that their neighbors suffering from alcoholism were a hassle to work with in S/A promotion.

“Land issues” was the top reason given for non-integration, while it was the second reason given for barriers. On the other hand, the number one barrier for integration was that S/A requires too much work from the farmer. This answer was the

Figure 1.4 What barriers are in place to prevent S/A adoption?

third most popular given for non-integration. Table 1.1 in the discussion chapter summarizes these differences.

4.3.2 Sustainable Agriculture

4.3.2.1 Reasons for S/A integration

Although there were not as many S/A farmers in each community, many of their interviews went into much more depth as compared to the slash and burn farmers. Farmers mentioned many reasons why they integrated these techniques into their farms. The word integrated is used because these farmers built upon traditional techniques that they were already using by adopting S/A. They were not doing a 100% change from one system to the other.

These trends are summarized in Fig 1.5. According to the results of the survey, the single top reason (27%) for integrating S/A into their farms was because their “harvests were improving under this system”. The next most popular response was that the farmers were forced to change due to “worsening harvests” (19%). This was followed by a desire to “improve the local environment (soils, water supplies)” and that farmers “liked the work” (18%). Other responses were “for future investment” in reference to tree plantations and soil conservation (13%). Finally the “Other” category filled 5%.

4.3.2.2 S/A techniques used

As mentioned earlier, “sustainable agriculture” comprised several different techniques. S/A farmers were asked which techniques they were using. These trends are summarized in Fig 1.6. It should be noted that many farmers incorporated several different techniques on the same farm; therefore there was a wide variety of responses.

Figure 1.5: Reasons for Integration of S/A Techniques into Farms

Figure 1.6: Most Popular S/A Techniques Used

The most popular techniques mentioned by the farmers were “rice tanks (aquatic rice farming)” and “soil conservation techniques (live and dead barriers, terrace farming)” (21% each). These were followed by “tree plantations” and use of “organic fertilizers and pesticides” with 15% of the responses each. “Organic farming,” meaning no inputs, followed at 13%. Next was incorporation of “green manures” into their farms (11%). Finally “vegetable farming” represented 4% of the responses.

4.3.2.3 Benefits through use of S/A

Farmers were then asked to list the benefits obtained from sustainable techniques. These responses are summarized in Fig. 1.7. There was a wide range of responses. “better harvests” and “improves soils and environments” were the most popular benefits representing 25% of the responses each. These were followed by “better livelihoods” and “more harvest on less land or using less seeds” representing 11% of the responses each. Other responses were “cheaper,” “multiple harvests in the same year,” which is in reference to using rice tanks, and “other” representing 6% of the responses each. Next was “improved long term results” (4%), followed by “can use techniques in any soil type” and “able to use same piece of land indefinitely” (2% each). Finally 2% of farmers mentioned that there were “no benefits” to S/A.

4.3.2.4 Direct impacts of S/A

Next farmers were asked to list the direct impacts on their lives that use of S/A techniques have had. Fig. 1.8 shows that 45% of the farmers mentioned that they have “improved harvests” due to using S/A. Farmers also mentioned that their “livelihoods improved” through the fact that using S/A freed up their time so they could spend more time with family. This is contrary to the claim that S/B farmers make that S/A is too

Figure 1.7: Benefits to Sustainable Agriculture

Figure 1.8: Direct impacts on lives due to incorporation of S/A techniques

much of a time commitment. Livelihood improvements also included farms being located closer to home and improved incomes (25%). Twenty percent of the respondents claimed they were able to find additional “off-farm employment” due to their experiences with sustainable agriculture. Finally 10% of farmers mentioned that they have “less work,” meaning less farm-related work since they have integrated S/A into their farms. This last response could be an indirect cause of improved livelihoods, the second most popular response.

4.4 SOCIOLOGICAL RESULTS

In addition to farm-related questions, general questions were asked about the socioeconomic conditions that farmers face.

4.4.1 Harvest

Table 1.2 lists the breakdown of the responses between S/A and S/B farmers. For the slash and burn farmers, 31% responded that harvests were getting worse. Only about 6% of S/B farmers reported an improvement in harvests. On the other hand, 55% of S/A farmers reported improved harvests and none (0%) reported worsening harvests. These observed trends are what would be expected, but require larger sample sizes to be statistically validated.

Combined data results can be found in Figure 1.9. According to the combined data, 31% of farmers mentioned that harvests were worse, while the same amount reported better harvests. Twenty-one percent reported that harvest quality depends on the year. Farmers also reported the harvests to be about the same (10%) and that harvest was best the first year after a burn (7%). Fifteen percent of farmers did not respond to this question.

Figure 1.9 Combined Data on Harvest Conditions

4.4.1.2 Harvest use

Results for this section are summarized in Table 1.3. All respondents to the survey mentioned that they used the harvests for consumption. Just 16% had extra harvest to sell to either neighbors or a local market. One-third of the S/A farmers had extra harvest to sell, while 12% of the slash and burn farmers reported having extra harvest to sell.

Thirty-five percent of the respondents stated that their harvests were insufficient to meet household needs for the entire year. This is compared with 8% of farmers stating that their harvest lasted all year and 7% of farmers stating that it depended on the year. Eighteen percent of the farmers did not respond to this question.

4.4.2 Outside Income

For these results, data was pooled and can be found in Fig. 1.10. Many of the farmers relied on outside income to supplement their activities (76%). Many had jobs outside of the community working in Santiago or Panamá City or for a local sugar cane refinery (35%). Other farmers noted that family members living outside of the community send money home (19%). Farmers also worked as laborers on other farms (19%). Other farmers worked as paid agricultural promoters in other communities (16%). This number applied only to the S/A farmers, and represented 66% of the S/A farmers interviewed (see section 2.2.4 in this chapter). Finally, 11% of farmers had jobs that did not fit into any of the above categories, represented by “other”.

Figure 1.10: Sources of Non-Farm Related Income

4.5 AGENCY AND FARMER RELATIONSHIPS

4.5.1 Farmer Perceptions of Working with Agencies

In Fig 1.11, suggestions for improving agency-farmer relationships from the point of view of the farmer are summarized. Almost one-half (49%) of responses suggested that agencies had to offer better “technical and financial support.” Other responses stated that agencies should “provide more supplies” (22%). Others called for more “consistency” with their work in the community (15%). This included that extension agents keep scheduled appointments, deliver supplies that they had promised and visit communities with more frequency. Other suggestions were “communities had to be open to working with agencies” (7%) and “having follow up activities to implemented project” (7%).

4.5.2 Agency Perceptions of Working with Farmers

World Vision has been working with the communities of Veraguas since 1990. Interviews with extension agents from this agency highlighted indicators, successes and barriers to promoting S/A agriculture in Panamá. World Vision trained over 90 farmers from 1990-1998 on a training farm that replicated conditions farmers faced in their own farms. Farmers participated in a one-year training with monthly follow up visits upon completion of their training.

World Vision felt that as an agency, they have had numerous successes within Panamá. They have implemented numerous training programs Panamá-wide that have touched hundreds of lives. Their training programs have had high participant retention rates. They note that they have been successful in including farmer participation in the

Figure 1.11: Suggestions for Agency Improvement from Farmer Perspective

development of their training programs. Finally, they mentioned that the graduation certificate that farmers received upon completion of the one-year training is well respected within the Panamá agriculture world (Gutierrez, pers. comm.).

Workers were asked to list indicators of success. They mentioned that replication of the techniques by farmers is a major measure of success of their program. Also, more farmers practicing S/A due to promoter activity would indicate success. Ideally, they expected that each promoter would train ten other farmers in their communities.

Workers also listed some barriers they have encountered. Most notably was that after investing up to \$1500 per farmer, at least one-third of the trained promoters were no longer practicing agriculture. This is for a variety of reasons. Age played a major factor, as farmers aged 18-25 would leave the communities to look for better paying jobs in Santiago or Panamá City. World Vision mentioned that farmers aged 25-35 who were more established in their communities (married with kids) had higher retention rates. Furthermore, workers observe that inconsistent market availability compounded by the fact that many farmers lived in inaccessible areas decreased motivation for farmers to continue to use S/A techniques. This observation will be commented upon in the discussion as it contradicts described benefits of S/A in both our observations and the literature. Finally, many farmers were forced to look for work elsewhere due to their marginal economic conditions.

CHAPTER 5: DISCUSSION

The main objective of this study was to assess the promoter system's effectiveness in La Mesa, Veraguas. Although we found little S/A adoption to support this system, several interesting trends were observed that could explain these observations. Therefore, it is important to discuss the trends observed. It is the hope that these observed trends can both assist agencies and provide the basis for future research.

This chapter is organized as follows. Section 5.1 will describe observed trends in farming techniques. Section 5.2 will describe observed trends in slash and burn agriculture. Section 5.3 will describe sustainable agriculture adoption trends. Sections 5.4 will describe the socioeconomic conditions farmers in this study face. Finally, section 5.5 will describe agency and farmer relationships.

5.1 FARMING TECHNIQUES

5.1.1 Slash and Burn Numbers vs. S/A Numbers

Of the sixty farmers interviewed (41 plus focus group), 13 were practicing sustainable agriculture techniques. The focus group had one S/A and 19 S/B farmers. Of the 13 S/A farmers, only six were first generation adopters, while seven were the original promoters. One of the objectives of this study was to assess the effectiveness of the promoter system as an extension tool. Our observations showed that seven promoters had influenced six other farmers to incorporate S/A into their farms. This number is low considering that each community had at least one promoter. It is also low considering that these communities had been receiving technical support from numerous agencies since 1990. Finally, these numbers fail to meet the expectations set by World Vision

trainers. These trainers expected that each promoter would train at least ten other farmers in their respective communities (Gutierrez, pers. comm.).

One possible explanation is based on observations by Buckles *et al.* (1998) and Buckles and Triomphe (1999) in Honduras. They observed that in the first ten years following the introduction of a technique, there is very little adoption, followed by an explosion in adoption of the introduced techniques. In our study, all but one of the promoters interviewed had been practicing S/A techniques less than ten years. The one promoter who had 13 years of practicing S/A commented that in the last two years, many more farmers were showing interest in learning the techniques he was using. This could give some validity to Buckles' Honduras observations to the Panamá situation. It would be interesting to do a follow up study in these communities five years hence to measure the number of new S/A farmers in these communities.

Because this study focuses on promoters who have been working in their communities less than ten years, our study's observations may be premature. Nevertheless, other studies investigated adoption trends that occurred at a more rapid rate. Bunch (1982, 1990 and 1997) and Neill and Lee (1999) observed on repeated occasions in Honduras that technology transfer through farmer to farmer extension occurred spontaneously⁵. In Africa, Miiro *et al.* in Reig and Waters-Bayer (2001) quantify technology transfer between first generation farmers (learned from promoters) and second generation farmers (learned from first generation). Over an unspecified time period, they documented that 32 trained promoters led to 500 first generation adopters

⁵ It should be noted that neither study mentioned how many years constitutes spontaneity, but it is assumed that it is considerably less than ten.

and 1500 second generation adopters in various communities in Uganda. This constitutes a rate of about 16 first generation farmers trained per promoter. Our study had a rate of less than one and zero second generation adopters by comparison. These trends do not support our expected results that the promoter system should lead to higher adoption rates. Because there are a variety of factors that influence farming decisions, these explanations are not sufficient to explain our trends. The following sections will explore factors that may have influenced farming decisions.

5.1.2 Summary

Interviews with 53 farmers and 7 trained promoters discovered only 6 first generation adopters. Compared with investigations from other countries, these numbers are relatively low. Promoters in our study have only been practicing these techniques in their communities for a relatively short amount of time. This may be a possible explanation for the low adoption rates. It was suggested by Buckles *et al.* (1998) that ten years practicing in a community is the minimum amount of time needed before widespread adoption occurs. This is contradicted by studies by Bunch (1982, 1990, and 1997) and Neill and Lee (1999) who observed spontaneous technology transfer and adoption. Due to these contradictions, it is necessary to discuss reasons farmers gave for adoption and non-adoption in order to explain the relatively low first generation adopters.

5.2 SLASH AND BURN AGRICULTURE

If the study communities have received technical support for a various number of years and even have their own promoters, why have sustainable agriculture techniques not been more widely adopted? The study attempted to answer this question through conversations with slash and burn farmers. Farmers were asked to give reasons for using

slash and burn agriculture as well as reasons and barriers for non-adoption of sustainable agriculture techniques. The following section discusses the responses of these farmers.

5.2.1 Reasons for Using S/B

In order to fully understand why farmers may not incorporate sustainable agriculture onto their farms, it is important to look at the reasons farmers rely on slash and burn techniques. Tradition, personal preference, easier and faster results and land issues were the top four reasons given for practicing slash and burn agriculture. The focus group yielded similar results, claiming tradition to be a top reason for use of S/B. Land issues, will be discussed in the next section in order to avoid repetition.

5.2.1.1 Tradition

Observations from this study show that tradition in rural Panamá plays a major societal role. Farmers practicing slash and burn agriculture have been doing so all of their lives. They learned these techniques from their parents who had learned from their parents. This produces a sentiment among farmers that they feel they “need” to burn the land in order for the soil to have the proper nutrients. It is also a powerful force to counter, as those who adopt S/A go against social pressures. This alone may be enough for farmers to not integrate S/A techniques into their farms.

5.2.1.2 Personal preference, ease of work

Farmers mentioned that they prefer to use S/B techniques. This could be related to the fact that farmers perceive these techniques to be easier to use. In order to prepare the land, all they have to do is clear a small swath of land and light a match. This is infinitely less work than establishing the contours of a hill, making barriers, planning a farm, making organic fertilizer, and/or developing rice tanks etcetera. This could also

explain the low adoption rate, as farmers have the perception that S/A is more work therefore they may not want to invest the time and energy in converting their farms. These comments are contrary to S/A farmer observations that S/A techniques are easier than S/B techniques in the long term. While S/A farmers report that their techniques are easier over the long term, farmers still have to be willing to invest high amounts of labor at the onset. If S/B farmers already prefer their methods, it may be difficult to convince them to invest higher labor for the next three years in order to implement S/A.

5.2.1.3 Faster results

Finally, farmers feel that slash and burn agriculture yields faster results. Sustainable agriculture does not begin to produce markedly better results until after several years of continued use, depending on the health of the soils in the area. Most farmers do not have the luxury to wait for these results. Even promoters trained in sustainable agriculture techniques who have seen the results acknowledge this point. One promoter interviewed had a job outside of his community for two years, forcing him to abandon his farm that he had been converting into an S/A farm. He mentioned that upon returning to the community, he used slash and burn to prepare his land for the first couple of years due to the more immediate results it produced. As he was in a position where he needed known results, he relied on slash and burn agriculture to yield those results.

Although these reasons are not widely mentioned in the literature, a study by Barbier (1998) in Africa supports our observations. They found that when faced with the choice of expanding their farm (the traditional practice) vs. land intensification (S/A) farmers preferred to expand their farms. Tradition, personal preference and use of trusted

techniques all played factors in the decision to expand their farms vs. intensify (Barbier, 1998).

5.2.1.4 Summary

Tradition plays a major role in a farmer's decision to use S/B agriculture techniques. This comes from farmers feeling social pressure not to change their techniques. Farmers consider slash and burn to be less labor intensive than S/A. As a result, farmers mention that they prefer to use these methods. Finally, farmers feel that S/B yields faster and more reliable short term results than S/A. Even S/A farmers agree with this point. In a couple of cases, S/A farmers who returned to their farms after a prolonged absence returned to S/B techniques to prepare their land because of the faster results.

The next section expands on these observations by discussing the reasons and barriers for non-adoption of S/A.

5.2.2 Reasons and Barriers for Non-Adoption of S/A

Due to the answers being similar, both reasons and barriers for non-adoption of S/A will be discussed together to avoid repetition. The main difference between both categories is that "Barriers" included responses from both S/A and S/B farmers while "Reasons" included only S/B farmers.

The organization for this section is as follows: In section 2.2.1, land constraints, an answer for "reasons for using S/B" "reasons for non-adoption" and "barriers to S/A adoption" will be discussed in depth. This section will also be a discussion of the barrier "lack of appropriate equipment." In section 2.2.2, "Labor Issues" will address the reason

and barrier responses that S/A is too much work. In section 2.2.3, a discussion of the reasons: “waiting for results from other farmers” and “lack of interest” will follow.

As mentioned in the section 2.1 of the results chapter, the “other” category will not be discussed in depth as a reason for S/B farmers not adopting S/A due to its vagueness. After removing the “other” category, the top four reasons S/B farmers gave for non-adoption of S/A techniques were “land constraints,” “lack of interest,” “waiting for results from other farmers,” and S/A being “too much work.” The focus group mentioned reasons for non-adoption as (in no-particular order) land issues, too much work and lack of start-up capital.

The top four barriers mentioned for S/A were “too much work” followed by “S/A being too expensive,” “land constraints” and “lack of appropriate equipment.” The focus group mentioned (in no order) that lack of appropriate equipment, S/A being too expensive, and lack of follow up by agencies as barriers to S/A adoption. Table 1.1 outlines the responses and how they rank according to each category.

Table 1.1 Reasons for non-adoption vs. barriers for non-adoption

Response	Reason Rank	Barrier Rank
Land Constraints	1 st	3 rd
Lack of Interest	2 nd	N/A
Waiting for results of S/A farmers	3 rd	N/A
S/A is too much work	4 th	1 st
Lack of appropriate equipment	N/A	4 th
Too expensive	N/A	2 nd

5.2.2.1 Land constraints

The top reason farmers gave for non-adoption, the third top barrier, and the fourth most popular reason for using S/B, land constraints, was a combined category. Land constraints ranged from farmers perception that their land was not appropriate for use of sustainable agriculture activities to farmers not owning their own farms. Land ownership and land being inappropriate for S/A will be explored in depth.

5.2.2.1.1 Land ownership

Land ownership has been noted in several studies as a barrier to integration of sustainable agriculture techniques (Buckles *et al.*, 1998; Fischer, 1998; Buckles and Triomphe, 1999; Lapar and Pandey, 1999; Fischer and Vasseur, 2002; Bannister and Nair, 2003; Pattanayak *et al.*, 2003). This is an obvious limitation due to the fact that for

a farmer to utilize sustainable agriculture techniques on their farm, they need to invest a large amount of labor, time and resources in the first couple of years. This is counterproductive for the farmers if this investment is done on rented land. As a result, the farmers themselves will not be the sole beneficiaries of their hard work. Therefore, it is more likely that farmers will utilize slash and burn methods on rented land. Research done in Panamá and other countries supports this point.

A study by Buckles *et al.* (1998) in Honduras notes that landowners were much more likely to adopt S/A techniques than farmers who rent land. Lapar and Panadey (1999) also observed that non-adopters tended to be non-landowners as well. Both of these studies contradict an earlier study by Strauss *et al.* (1991) that states that land ownership is a non-factor in technology adoption. Bannister and Nair (2003) conclude that farmers would be less likely to incorporate tree grafting (another S/A techniques not mentioned in this study) on rented land. Pattanayak *et al.* (2003) also observe that land tenure plays a major role in S/A adoption. Finally, in Panamá, Fischer (1998) and Fischer and Vasseur (2002) note that farmers were less likely to incorporate sustainable agriculture techniques if they were unsure of land tenure. Based on these studies, it can be concluded that for farmers to adopt new technologies, they should be landowners.

Although an important observation globally, only 6.7% of farmers interviewed in this study rented land for farming. The next section explores a more prevalent issue affecting non-adoption: the perception of farmers that their land is inappropriate for incorporation of S/A Techniques.

5.2.2.1.2 Inappropriate land and equipment

The observed trend that many farmers have the perception that their land is inappropriate or that they do not have the proper equipment to practice sustainable agriculture is both interesting and unfortunate. This is an unfortunate perception because as one experienced development worker commented; “sustainable agriculture techniques could be used in any area, under any condition.” He further commented that when using S/A “there are no bad soils” (Gutierrez, pers. comm.; translation mine).

So if S/A can be applied successfully in any kind of soils, why did farmers in this study describe their land as inappropriate for these techniques? The reason may be that agencies have been using inappropriate training methods or introducing inappropriate technology. This is supported by the fact that farmers interviewed mentioned that they would adopt S/A if they had the appropriate equipment. Furthermore, observations by agency workers that inconsistent market availability compounded by the fact that many farmers lived in inaccessible areas decreased motivation for farmers to continue to use S/A techniques (Gutierrez, pers. comm.). By contrast, this should be the exact motivation for farmers to adopt S/A (Bunch, 1982). Perhaps this perception of the agencies is the reason that farmers are not adopting.

This is worrisome due to the fact that Bunch in his landmark book “Two Ears of Corn” (1982) stressed the need for using appropriate technology when working with rural farming communities in the developing world. His argument was made after highlighting several development projects that failed due to using in-appropriate technology such as large machinery in areas where farmers were accustomed to planting by hand.

Unfortunately, this is not an isolated phenomenon.

Several studies state that lack of technological knowledge or inappropriate technology integration hinder adoption (Fischer, 1998; Lapar and Panadey, 1999; Franzel *et al.*, 2001, Fischer and Vasseur, 2002). Furthermore, several studies suggest this is a result of agencies failing to incorporated local indigenous knowledge into their extension efforts (Messerschmidt, 1988; Martin and Sherington, 1997; Fischer, 1998; Fischer and Vasseur, 2002).

Perhaps as a result of inappropriate technology transfer, farmers in our study felt that in order to incorporate S/A techniques, they needed flat terrain to do so. This differed from findings by Buckles *et al.* (1998) in Honduras. Buckles *et al.* (1998) observed that farmers with steeper fields in Honduras were more likely to adopt S/A soil conservation techniques. This difference may not be just a regional one. Based on the body of literature discussed above, this may be due to inappropriate methods utilized for training farmers in their communities.

Agency involvement with communities plays a key role in agricultural development in Panamá. It was observed in conversations with farmers, agencies and personal observation that in Panamá agencies will push one or two key techniques in a community without thinking about the practical feasibility of these techniques' use. Furthermore, these techniques, such as rice tanks, are demonstrated on land ideal for application, but farmers in these communities rarely have land that is suitable for rice tanks. This may lead to farmers thinking that they cannot replicate any sustainable agriculture on their own farms.

To further demonstrate this point, a curious anecdote arose out of the focus group interview. In this community an agency had set up a demonstration farm using a tractor-

tiller to prepare the land and the rice tanks. In doing so, they failed to show the community how to prepare the land with the tools available in the community. This left the community members to think that the only way they could utilize these techniques on their farms was to use the tiller. At the end of the project, the agency took away the tiller, and the farm is currently overrun by weeds. The damage extends past this farm as farmers interviewed in the focus group mentioned that the main reason they do not adopt S/A techniques is that they lack this tiller to properly prepare their land. It did not matter to the farmers that the majority of their farmed lands are extremely hilly, far away and accessible only by foot therefore realistically impossible for use of a tractor tiller. In the end, the farmers believed that they needed a tractor tiller in their community in order to incorporate sustainable agriculture. Unfortunately this story has repeated itself over and over in Panamá (personal observation), possibly rendering numerous communities into a stage of learned helplessness or agency exhaustion (Bonnell pers. comm.). This could help explain why so few first generation adopters were observed, as these communities may be just waiting for the next project to come along to provide materials (Gutierrez, pers. comm.).

5.2.2.2 Labor issues and expenses

Too much work was the top barrier and fourth top reason farmers gave for non-integration of sustainable agriculture techniques. Related to this was the second most popular barrier mentioned that S/A is too expensive. These are factors in adoption that some studies have alluded to (Sperling and Loevinsohn, 1993; Lapar and Pandey, 1999; Fischer and Vasseur, 2002). This observations come in light of the fact that it is has been proven both by users of S/A and in the literature that over the long term, S/A is actually

less labor intensive than slash and burn. However, in the first few years of utilizing S/A, it does require more labor. This is confirmed by one promoter in the study who said S/A requires a considerable amount of “dedication and discipline” in order to be successfully practiced. After these first years, the benefits of the techniques begin to be seen and labor requirements are decreased. While it may be obvious to those outside of the communities, farmers within the community generally may not see these advantages. This is especially illustrated by the observation that only 31% of slash and burn farmers had a long term farming plan, while 75% of sustainable agriculture farmers had a long term farming plan. This observed trend suggests that slash and burn farmers are not looking beyond the current year’s harvest, and therefore not thinking of the possible long-term benefits of S/A.

If a farmer is not planning beyond the current year’s harvest, it may become difficult to demonstrate that S/A techniques are better in the long term. As a result, it is a challenge to convince the farmers that they should invest larger amounts of labor to initiate S/A activities. This is especially the case if they will not see the benefits immediately. A possible solution to overcoming this difficulty would be to allow farmers to integrate techniques they deem important to their farms. In this sense, techniques that can have a positive effect for the farmer do not necessarily need to be the optimum techniques that agencies prefer (Ashby *et al.*, 1996). This would be a way to integrate indigenous knowledge into S/A techniques. After all, some change, although not optimal, is better than no change.

One example of this integration applicable to the Panamá experience is as follows. This is based on personal observations and interviews over many years

experience working in this field. Many Panamanian farmers normally plant several different species of beans for consumption. Meanwhile, agencies promote planting legumes *mucuna* and *canavalia* for cover crops or green manures (Gutierrez, pers. comm.). Both of these species are strong nitrogen fixers but have little other use, commercial or household. Agencies may view the non-adoption of *mucuna* and *canavalia* as a failure, while farmers may not see the reason for integrating a crop that has no other practical use. A solution to this issue would be to encourage and educate the farmers that the beans they are planting can also serve as green manures, since legumes generally are nitrogen fixers. Although these species are not optimal green manures like *mucuna* and *canavalia*, they at least can meet the farmers' needs without increasing the labor requirements or incorporating a drastic change.

Another solution would be for the encouragement of small scale experimentation on their farms (Bunch, 1982). This allows farmers to incorporate S/A on their own terms, as it relates to their needs and available resources, thus making S/A an attractive addition to their traditional methods.

5.2.2.3 Waiting for results of other farmers and lack of interest

These third and fourth most popular reasons for non-adoption of S/A are discussed together due to the fact that they are generally related. Minimal observed adoption does not necessarily indicate that farmers will never incorporate S/A into their farms. In this study, 98% of the farmers were aware of S/A techniques, suggesting that they are conscious of different ways of farming. According to our observations, they may not be adopting due the fact that they are waiting for results of other farmers or are generally not interested.

One anecdote from the study illustrates the potential for future adoption. One of the promoters interviewed has had more than 13 years experience on his farm using S/A techniques and is just starting to see results. He is now experiencing some success such as extra harvest to sell, while his neighbors are seeing diminished harvests from year to year. He mentioned in the interview that he has neighbors who are just starting to show interest in the techniques he is using on his farm. These are the same farmers who had little interest in his techniques just five years ago when he attempted to work with the community as a whole. The lesson learned here is that farmers who were once not-interested were showing great interest when they saw the success of this farmer. While our study did not observe widespread adoption, perhaps as S/A farmers demonstrate increased harvests, more S/B farmers will become adopters.

Although it may appear that farmers may not be interested in adoption of S/A, they may be waiting for the techniques to be proven successful before they integrate them into their farms. This may imply that farmers are unwilling to attempt the risk of incorporating S/A techniques until they can see proven results. Personal observations along with farmer responses suggest that many are in extremely marginal economic conditions. This leaves very little room for risk taking.

This study observed that with all things being equal, S/B farmers can generally depend on about the same amount of harvest each year. A change in techniques would mean that they would assume a certain degree of risk that the harvest will be less for that year. As there is barely enough harvest to feed a family for a year (section 4.1.1 in this chapter), they are in no position to take this risk. Therefore, adopting new techniques without knowing what results they will bring puts the farmer at great risk for that year.

Although our study does not have direct data addressing this point, there is substantial support in the literature. Risk aversion has been described as a limiting factor in new technology adoption (Kebede *et al.*, 1990; Fischer, 1998; Franzel *et al.*, 2001; Fischer and Vasseur, 2002; Bannister and Nair, 2003; Pattanayak *et al.*, 2003).

5.2.2.4 Summary

The top reasons given by farmers for non-adoption of sustainable agriculture were land constraints, too much work, lack of interest, and waiting for results of other farmers that are using S/A techniques, this last point may imply risk aversion. The top barriers listed were too much work, S/A being too expensive, land constraints and lack of appropriate equipment. Land ownership is a major barrier as farmers are less apt to integrate new techniques onto land they are renting or that they do not own. Land constraints ranged from perceived inappropriate techniques to lack of ownership. That farmers feel that their land is inappropriate for S/A may be the result of misplaced technical support from agencies. This could include introducing technology not appropriate for the community. To support this point, farmers mentioned that they lacked the appropriate equipment as a barrier for S/A integration. Farmers feel that S/A techniques are too much work and this limits adoption. S/A often initially does require a large amount of invested time, labor and in certain cases, money (in some cases new tools or equipment may be needed), but is easier and cheaper in the long term. If farmers are not planning beyond the current year's harvest they will not be able to foresee these long-term benefits. Other farmers are waiting to see the results of their neighbors practicing S/A before they integrate these techniques onto their own farms. This could imply that

farmers are unwilling to risk integration of a new technique until it has been proven to work.

5.3.0 SUSTAINABLE AGRICULTURE

While the previous section described reasons that S/A was not being adopted, it is also necessary to understand reasons for adoption. This can illustrate to agencies positive experiences to build on. This may further prevent agencies from reinventing the wheel. Through conversations with farmers who adopted S/A, several reasons for adoption were given. The following section discusses why farmers use S/A techniques in their farms, what techniques they used, benefits they receive through use of S/A, and direct impacts of S/A on their lives.

5.3.1 Why Farmers use Sustainable Agriculture

Thirteen farmers who used S/A techniques and did not use S/B techniques were identified in this study. These farmers were very enthusiastic about the benefits they were receiving from these practices. In order to understand why they were using S/A, farmers were asked why were they utilizing S/A practices in their farms. The top four reasons given were that S/A techniques “improved harvests”, “farmers enjoyed the work associated with S/A techniques”, a desire to “improve the local environment” and that their farm conditions “forced them to change.”

5.3.1.1 Improved harvests

Improving harvests is especially important to farmers in areas where harvests barely last a full year. This means that farmers have months where food insecurity is high. This also means that there is very little chance for extra income generated from sale of excess harvest. The observation that S/A is generating extra harvests for the

farmers is encouraging. This shows that S/A techniques are proving to be an advantage over S/B. However, harvests do not necessarily have to improve for farmers to feel that these techniques are effective. Many farmers mentioned that they were able to have improved or continued harvests using the same amount of seeds or even less land. This demonstrates an economic advantage for some techniques, in that farmers are investing less into their farms for the same results. This can free up money for other household activities, especially since markets are difficult to access for many of these farmers.

Similar results are found in the literature. An investigation on farmer innovation in Africa found that farmers innovated in order to increase food to the household (Nielson and Flemming in Reij and Water-Bayer, 2001). Fischer (1998) found that the top reason farmers gave for adoption of agroforestry techniques was for domestic use, including better harvests and a better variety of foods in their diet.

Should our observed trends continue with larger sample sizes, they would be different from that of Buckles and Triomphe (1999). Buckles and Triomphe (1999) investigated green manure application in Honduras. They found that the top reason farmers gave for adopting green manures was for improvement of the soil. Our trends also differ from Traoe *et al.* (1998) who concluded that increasing the financial value of the farm is a major motivating factor for integration of S/A techniques for North American farmers.

Despite a lack of statistical support, these observed trends can be a motivational tool for other farmers to begin to integrate S/A techniques into their farms. S/A Farmers interviewed commented overwhelmingly that they are enjoying better harvests. Additionally, the literature supports our observations (Fischer, 1998; Nielson and

Flemming in Reij and Waters-Bayer, 2001; Fischer and Vasseur, 2002). Therefore agencies should not have to wait for another study to validate these results statistically before taking action. Improved harvests can also provide proof to S/B farmers that these techniques tend to be effective (see section 2.2.5 of this chapter). Finally, improving harvests means that livelihoods may be improving. This means that farmers may have more income or improved food security (section 3.3.2). This can allow farmers to invest in other areas of their lives such as their children's education, household activities, social events, and etcetera.

5.3.1.2 Enjoy the work

S/A farmers noted that they enjoyed the work that is associated with sustainable agriculture techniques. This is interesting since many of S/A farmers interviewed mentioned that S/A is a considerable amount of work compared to S/B during the initial years of integration. Many factors could account for this enjoyment. One, as mentioned by one promoter, is that these techniques require that a farmer pay much more attention to his farm. As a result, they may become much more invested both physically and emotionally. Also, as the work continues, farmers are able to see a transformation of their farms and directly able to see the fruits of their labor. One of the S/A farmers who had been practicing the longest (13 years), noted with a considerable amount of pride how much better the soil looked compared to how it was when he started. These farmers essentially become scientists in their own right and begin to take enjoyment in watching their experiments come full circle. This confirms Bunch's (1982) suggestion that the farmer's ability to experiment will influence adoption patterns.

Finally, it was well noted anecdotally by farmers and agency workers that labor requirements lessen considerably after the first couple of years (Gutierrez pers. comm.). In the long term, this means that S/A requires less work than S/B. This frees up time for other activities such with family, church, and community. This improved livelihood probably factors into the enjoyment of their work. Section 3.3.2 explores the importance of improved livelihoods for S/A farmers.

5.3.1.3 Improve the local environment

S/A farmers also noted that they adopted these techniques with a strong desire to improve the local environment. Almost all of the farmers interviewed noted a considerable change in the environment, most notably that there was less rainfall and more droughts. Many agencies in Panama attempt to convince farmers that they need to integrate these techniques because they are destroying the environment with slash and burn agriculture. It is noted by looking at the landscape that S/B techniques are having a detrimental effect. Many communities are surrounded by denuded and highly eroded hills where farmers attempt to cultivate the land. These practices can have devastating effects on local forests as well. Laurence and Williamson (2001) describe severe secondary environmental effects due to clear cutting for agriculture in Brazil. They note that agriculture activity contributes to a positive feedback loop that leads to even more deforestation and drought over the long term.

Farmers that adopt S/A techniques for this reason demonstrate advance forward thinking and leadership abilities. Because these promoters were selected by their communities to participate in the training, many have demonstrated leadership capabilities. They have also been leaders of several other community improvement

projects. Leadership has been well cited as a key quality of innovating farmers and promoters (Selener *et al.*, 1997; Versteeg *et al.*, 1998; Reij and Waters-Bayer, 2001).

5.3.1.4 Land conditions forced a change

The fourth most popular reason was that the land conditions forced a change. This supports the observation that if farmers do not see a need to change, they will not change. Many S/A farmers mentioned that their land failed to produce and that the soil was “tired” (*cansado*). Population pressures limited the available land farmers had for agriculture. Therefore they could not venture further into the forest, so they had to change their techniques. This entailed using the same plot of land in a sustainable way in order to ensure their survival. Were this not the case, farmers would probably still be practicing S/B.

These findings support those of several other studies that mention that population pressures will affect farmer land use decisions (Barbier, 1998; Franzel *et al.*, 2001; Lapar and Pandey, 1999; Reij and Waters-Bayer in Reij and Waters-Bayer, 2001). One particular study by Lapar and Panadey (1999) uses a discussion of population density vs. market accessibility to determine reasons farmers change their techniques.

In their study, it was determined that high population density combined with high market access and well defined property rights will allow farmers to adopt more soil conservation methods. Based on these findings, high population density and well defined property rights may help explain our observations. Market access, on the other hand, was not a factor because few farmers sold their harvests on the market. Our study did not look at population density, but each town visited had clearly defined property boundaries, whether they were part of a collective or the land owners held titles. As a result, farmers

were limited in their expansion and fallow times were getting shorter and shorter forcing a change in their methods. Further studies to investigate population densities and land use decisions would be beneficial to the Panamanian agriculture community.

5.3.1.5 Summary

Farmers using S/A techniques mentioned that they were observing improved harvests compared with S/B techniques they had been using. This was the top reason for using S/A, differing from some of the literature. Improved harvests were important to farmers in areas where harvests are insufficient to meet food needs for the year. Also, farmers were able to harvest about the same amount using less seeds and inputs under S/A, meaning less economic costs. Farmers also noted that they had enjoyed the work associated with S/A. This could be due to the fact that farmers are more invested in their farms, and are seeing the positive results; therefore they are taking stock of their hard work. Farmers are also using the S/A techniques to improve the local environment in response to longer dry seasons and poorer harvests from year to year. This shows initiative and leadership in using these techniques possibly a necessary quality of a promoter. Finally, farmers mentioned that they use S/A due to land conditions forcing the issue. This stems from population pressures and well defined property rights which limits expansion of agriculture lands, forcing farmers to utilize the same lands indefinitely.

5.3.2 S/A Techniques Used

Sustainable techniques farmers use in their farms vary depending on their land, techniques taught, and techniques preferred. The top techniques mentioned by farmers were rice tanks, soil conservation techniques, tree plantations and use of organic

fertilizers and pesticides. Agencies in the Veraguas province have long been promoting use of rice tanks as a means to produce a large amount of rice with minimal land (Gutierrez, pers. comm.). Therefore it is no surprise that this is the technique most utilized. Every community visited was characterized by hilly terrain where soil conservation techniques such as terrace farming, and use of live and dead barriers prove to be beneficial. Soil conservation techniques have also been widely adopted in Honduras, which has similar hilly conditions (Bunch, 1982; Bunch, 1990; Buckles *et al.*, 1998). Tree plantations represent a means for long term income with minimal amount of work, explaining this popular technique. Finally, using organic fertilizers such as compost or *bocachi* (a Japanese version of compost), and pesticides provide a cost effective alternative to chemicals. This information could be useful to local agencies as it gives them an idea of what techniques farmers most likely will adopt.

5.3.3 Benefits and Life Impacts Through the use of S/A

Farmers were asked to list the benefits obtained from incorporating S/A techniques into their farms. The top four reasons given were “better harvests,” “improved soils and environment,” “improved livelihoods,” and “better harvests on less land or using less seed.” These will be discussed in the following section. Three of the responses, “better harvests,” “better harvests on less land or using less seed,” and “improved soils and environment” because of their interrelationship with each other will be discussed in the same section. Farmers were also asked to list direct impacts on their lives through the incorporation of S/A. The top four responses were “improved harvests,” “improved livelihoods,” “resulted in off-farm employment,” and “less work on

farms.” Improved livelihoods could be a result of off-farm employment and working less so will be discussed within this section.

5.3.3.1 Better harvests, using less land or seed, and improves soils and environments

Section 3.1.1 listed improved harvests and a desire to improve the local environment as top reasons farmers used S/A. Therefore, it should be no surprise that it is one of the direct benefits farmers list. Improved harvests could be a result of improved soils and environment through use of S/A techniques. This becomes a motivation tool for farmers to continue to utilize these techniques. It can also serve as a tool for agencies. These farmers’ successes can help agencies sell these techniques to non-SA farmers. Although statistical analysis could not confirm these results, relying on anecdotal evidence can be a good start for beginning more in-depth scientific investigation, policy decisions and training programs.

The ability to harvest about the same or more using less seed is also a key benefit listed by farmers. Conversations with farmers illustrated a couple of reasons for this. One of them is that farmers have a hard time buying seed due to economic pressures. Another key reason is that often there is little seed left over from this year’s harvest for the next year’s planting. If farmers are able to harvest about the same or more using less seeds, they enjoy a key benefit of needing less seed, which can be both cheaper and mean less anxiety for the farmer. This may be a reason why farmers mention that they are enjoying improved livelihoods as a result of using S/A techniques.

These observations are consistent with observations from other studies across the globe. Numerous studies have noted that farmers utilizing S/A techniques have demonstrated improved harvests when compared with S/B farmers (Bunch, 1990;

Buckles *et al.*, 1998; Reij and Waters-Bayer, 2001; Ye *et al.*, 2002). The consistency with our study's observations and that of the literature suggests that S/A can be a viable alternative to S/B in Panamá. More research will be necessary to support our observations.

5.3.3.2 Improved livelihoods, off-farm employment and less farm-related work

Section 3.1.2 alluded that improved livelihoods could be a reason that farmers enjoy work associated with S/A. Improved livelihoods could include how much extra time the farmer has for their family, enjoyment of their work, extra income from outside jobs among other things (Ashley and Hussin, 2000). In addition to improved livelihoods as a benefit to S/A farming, off-farm employment and less work were mentioned as top impacts on farmers' lives. Our observations support those of Ashley and Hussin (2000). They state that improved livelihoods could play as important of a role in adoption as measurable outputs such as improved harvests.

One way livelihoods could be improved is through employment based on farmers' experiences. The NGO World Vision not only trained promoters in sustainable agriculture techniques, they also helped to network outstanding promoters into technical positions with other agencies (Gutierrez, pers. comm.). Farmers receiving this technical training are then able to apply their knowledge while earning income for their families. This extra wealth can free up some insecurities and lower risk which combined are proven to be factors influencing S/A integration (Kebede *et al.*, 1990; Strauss *et al.*, 1991; Lapar and Pandey, 1999; Nasr *et al.* in Reij and Waters-Bayer, 2001; Bannister and Nair, 2003; Franzel *et al.*, 2001; Pattanayak *et al.*, 2003).

S/A farmers also reported that farm-related labor has decreased. This shows that they have gotten through the initial labor investment mentioned in section 2.2.4 of this chapter as a barrier to adoption. This lessened work frees up time for other activities such as family, church, sports, and etcetera. This free time is most likely related to farmers mentioning improved livelihoods as a direct impact to S/A. If farmers have time for other things they deem important in their lives, they will naturally report that S/A represents an improvement.

5.3.3.3 Summary

The top four S/A techniques used were rice tanks, soil conservation techniques, tree plantations and organic fertilizers and pesticides. This information is useful to agencies so that they know what techniques farmers prefer and promote those techniques. S/A farmers noted several benefits and impacts on their lives through the incorporation of S/A techniques into their farms. Many noted improved harvests as a top benefit. Others noted that they were using less seed or land than before. Another top benefit/impact was that farmers were noticing that S/A techniques were improving the local environment. Finally, farmers were commenting on improved livelihoods which could be a result of less farm-related work and off-farm employment opportunities associated with S/A use.

5.4 SOCIOECONOMIC

Farmers were asked to list differences in several sociological and environmental conditions they have witnessed throughout the last ten years in order to determine pressures they are facing on their farms. The results are summarized in this section and will be broken down into two categories: Sociological and Environmental.

5.4.1 Harvest

As mentioned above, S/A farmers noted improved harvests as a reason for continued use. These farmers also mentioned that their harvests have generally improved over the last ten years. By contrast, S/B farmers mentioned worsening harvests over the last ten years. These observations illustrate an opportunity for both promoters and agencies for the promotion of S/A. If S/B farmers mention that they are waiting for the results of S/A farmers before they adopt, then improved harvests should be evidence enough.

5.4.1.1 Harvest use

All of the farmers in this survey said that they used the harvest primarily for consumption. Few of the respondents mentioned that the harvest lasts for the entire year. This means that very few farmers have extra harvest to sell. Between the two groups, one third of the S/A farmers had extra harvest to sell, while only 12% of S/B farmers had extra harvest to sell. These results are consistent with farmer comments about improved harvests associated with S/A use. Should farmers have extra harvest to sell, they will enjoy improved livelihoods as a result. This too was an important benefit listed by S/A farmers.

One troubling trend is the large number of farmers who do not have enough harvest to meet household needs for an entire year. This indicates that many farmers are burdened by food insecurity. This may limit their ability to integrate new techniques into their farms that can improve the farm. Support of this observation comes from section 2.2.3 of this chapter. Generally, subsistence farmers have less room for error, therefore less freedom to integrate new techniques into their farms. This could be another reason

for the low numbers observed of S/A farmers despite strong agency and promoter presence.

5.4.2 Outside Income

The study noted that over half of the farmers reported some kind of outside income. Many worked for a sugar refinery harvesting sugar cane, while others received financial support from relatives working in the city. Having outside income lowers the risk farmers would take in adopting S/A, yet it is postulated that having outside income will also reduce any pressure to adopt S/A.

Perhaps farmers who were never exposed to S/A techniques will never have incentive to incorporate S/A techniques once they begin to receive supplemental income. The logic is that if they are receiving supplemental income, then there is really no incentive for them to invest the extra labor necessary for incorporation of S/A techniques as mentioned in section 2.2.4 of this chapter. The question may be as follows: Why should they invest the extra time needed if they have enough income to meet their food needs regardless of how much they harvest?

5.4.3 Other Factors

There were no marked differences between age, education level and family size between the S/B farmers and S/A farmers. This is most likely due to the small sample size obtained in this study. For age, this trend is consistent with the lack of agreement in the literature about the ideal age of farmers who incorporate S/A (Kebede *et al.*, 1990; Lapar and Pandey, 1999; Reij and Waters-Bayer, Nasr *et al.*, Nielsen, in Reij and Waters-Bayer 2001; Bannister and Nair, 2003; Thangata and Alvalapati, 2003, Gutierrez pers com, 2003). Larger sample sizes may demonstrate trends in education level and family

effects as demonstrated by the literature (Barbier, 1998; Franzel *et al.*, 2001; Lapar and Pandey, 1999; Reij and Waters-Bayer in Reij and Waters-Bayer, 2001).

5.4.4 Summary

Several socioeconomic and environmental factors were investigated in this study. In the towns visited, S/B farmers noted that harvests have been diminishing over the last ten years, while S/A farmers reported improved harvests. This could be a result of the respective techniques both farmers are using. Many farmers reported receiving some form of non-farm related income. This may be hindering S/B farmer adoption of S/A techniques.

5.5 AGENCY RELATIONSHIPS

5.5.1 Extension Style in Panamá and Farmers' Perceptions

Another factor investigated was local agency involvement in these communities. In Panamá, technology transfer generally follows a top-down pattern. This puts a heavy reliance on agencies. This is contradictory to observations in Honduras where several authors (Bunch, 1982; Bunch, 1990; Buckles *et al.*, 1998; Buckles and Triomphe, 1999; Neill and Lee, 1999) report farmer to farmer extension as the main technology transfer style.

It was implied in commentary by extension workers and promoters that for top-down technology transfer to successfully occur, a certain level of trust is necessary between agencies and farmers. Observations from this study show that almost half of the respondents mentioned that agencies could improve relationships by providing stronger technical and financial support to the farmers. This was a point mentioned by Fischer (1998) and Fischer and Lesseur (2002) in a study focused on Panamá.

Further observations noted that farmers acknowledge that they have to do their part as well. Twenty-two percent of the responses mentioned that communities had to be more willing to work with agencies. Some of these farmers commented that this could occur through being better organization or acceptance of technical advice. Finally, farmers mentioned that stronger consistency, providing supplies and follow up work are other areas where agencies can improve.

Based on the observations of this study and those in the literature, farmers feel that agencies could improve their methods of working in communities (Fischer, 1998 and Fischer and Vasseur, 2002). Not the entire burden needs to fall on the agencies, however. In defense of the agencies, many are overworked and underfunded. This results in agencies only being able to provide one extension agent who has to work with up to 35 communities. The budget woes are so bad that the Panamanian Agriculture Ministry (MIDA) cannot even afford to have telephones in all of their offices (personal observation)! This creates a virtually impossible situation where techniques cannot be successfully implemented into communities.

Nevertheless, there are many different agencies working in these areas. Unfortunately, there is little actual overlap and sharing of workload between agencies. Agencies, should they work together, would be able to cover more ground effectively. But this rarely happens, as these communities often become victims of competition between agencies, creating a type of “turf war.” One extension agent commented that they were prohibited from working with certain families by certain agencies (Gutierrez, pers. comm.). This was also observed personally by researchers. Researchers, in order to complete first visits, had to use a recently fired contact to do a site visit due to time

constraints. Upon hearing this, the agency expressed their displeasure with us for using this person, despite the fact that our study was benefiting this agency. This is an atmosphere that simply cannot take place and loses focus of who should be the beneficiaries: the farmers. A stronger organization between agencies should take place in Panamá in order to aid farmers to overcome barriers to S/A adoption.

5.5.2 Agency Perceptions of Working with Farmers in Panamá

Section 1.5 of the results chapter lists results of conversations with World Vision extension agents. The following discussion will only highlight a couple of major points from these conversations. Most notably World Vision's indicators, goals and difficulties will be discussed.

5.5.3 Indicators, Goals and Difficulties of Project Implementation

Replication was listed as an indicator of success for the promoter training program. This was also a indicator in the literature (Faminow and Klein., 2000; Fischer, 1998; Franzel *et al.*, 2001; and Fischer and Vasseur, 2002). World Vision also mentioned that for their program to be considered successful, each promoter should train ten farmers in each community (Gutierrez, pers. comm.). With only six new S/A users being identified in this study, it could be concluded that the World Vision has fallen short of their goals. This could be as a result of for a variety of difficulties that workers noted.

The main difficulty encountered was that many promoters dropped out of the program. This was due mainly to farmers either being younger or working outside the community to supplement income. This was found to be the case with several promoters interviewed in this study. Five of the seven promoters interviewed had been consistently working outside of their communities since being trained as promoters.

This becomes problematic for the promoters as they cannot be consistently working with their community. Since it takes a number of years to establish the success of these techniques (Buckles *et al.*, 1998), any activity that takes farmers outside their communities could be detrimental to widespread adoption. This becomes a difficult situation for the promoters to face. Many of the jobs the promoters took were a direct result of their promoter training. Although one should not discourage farmers to take advantage of these opportunities, perhaps more care should be taken in promoter selection. This is especially the case when the agencies' goals are for overall community development, not individual development.

Finally, when these results were shared with a former World Vision worker, he was not surprised. He commented that "Panamá is not an environment where agriculture is the main focus" (Gutierrez, pers. comm. translation ours). His comments reflect that it is much easier for farmers to receive non-farm income from family members or jobs than to change their agriculture techniques. These observations could represent another reason why integration of S/A in our study was not widespread.

5.6 OVERALL SUMMARY:

Compared with other countries, this study observed that there are relatively few farmers practicing sustainable agriculture despite the fact that there were seven trained promoters in five communities. This could be for several reasons. One could be that farmers have not been practicing these techniques in their communities for a sufficient amount of time. One study mentioned that S/A adoption took up to ten years after the initial introduction before the techniques become widespread. In contrast, other studies noted spontaneous adoption once techniques were introduced in communities. Due to

these contrasting studies, it became necessary to review reasons why farmers were practicing S/B or S/A.

Understanding the S/B farmers thought processes concerning use of S/B as well as barriers to S/A provide insight into the difficulties farmers face when making land use decisions. Tradition plays a major role in a farmer's decision to use S/B agriculture techniques. This comes from farmers feeling social pressure not to change their techniques. Farmers consider slash and burn to be less labor intensive than S/A. As a result, farmers mention that they prefer to use these methods. Finally, farmers feel that S/B yields faster and more reliable short term results than S/A. Even S/A farmers agree with this point. In a couple of cases, S/A farmers who returned to their farms after a prolonged absence returned to S/B techniques to prepare their land because of the faster results.

Numerous constraints to S/A adoption were mentioned. Land issues such as feeling that their land was inappropriate for S/A may be a result of inappropriate technology promotion by agencies. Farmers also mentioned that S/A is too much work. Although S/A does require a large labor investment initially, the work lessens over the long term. Other farmers are waiting for the S/A techniques to demonstrate their success before adoption. This suggests that farmers are interested, but implies that they are unwilling to risk integration of a new technique until it is proven.

The top four S/A techniques used were rice tanks, soil conservation techniques, tree plantations and organic fertilizers and pesticides. This information is useful to agencies so that they know what techniques farmers prefer and promote those techniques. S/A farmers noted several benefits and impacts on their lives through the incorporation of

S/A techniques into their farms. Many noted improved harvests as a top benefit. This could include farmers using less seed and land due to use of S/A. These reasons could be used by agencies to better promote S/A to non-adopters. Finally, farmers were commenting on improved livelihoods which could be a result of less farm-related work and off-farm employment opportunities associated with S/A use.

Several socioeconomic impacts were observed. Differences in observations of S/A and S/B farmers could account for the techniques they are using in their farms. Finally, many farmers reported receiving some type of outside income to supplement household needs. This could reduce the pressure farmers feel to change their techniques as basic needs are met by this income.

Farmers noted that agencies could improve their relationships with communities by providing better technical and equipment support. Also, interviews with agencies noted that while they feel they have been successful in S/A promotion, some barriers exist to full implementation. Finally, age and employment taking farmers outside the community could be factors that contribute to observed adoption rates falling well short of goals set forth by World Vision.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 OBJECTIVE CONCLUSIONS

Many topics have been discussed in the previous chapter. What can be concluded from this information is that there may be more questions created than answers provided. That seems to be the nature of sustainable agriculture work in the developing world. Nevertheless, studies such as this one are important in that they allow agencies and researchers in Panamá to take stock of observed trends. From there they can design programs that incorporate techniques that work, leave out ones that do not, and develop strategies to overcome barriers.

Research can benefit from these observations as well. Although no statistical significance was found in this study, a framework was laid that future investigations can follow. These site-specific observations for Panamá can provide valuable information for similar studies in the future.

For this chapter, the objectives of the study will be reviewed and concluding remarks will be made about each of the objectives. Each section will be closed with recommendations for agencies and future research

6.1.1 Objective 1: Review the Promoter System as a Tool for Sustainable

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The promoters interviewed in this study did not meet the goals set forth by World Vision of training ten farmers per promoter in each community. The first generation farmer rates also fell well short of those observed in the literature. Despite these observations, it may be premature to declare that this system is a colossal failure. Farmers have been working in their communities for only a short period of time, with

only one farmer who has been a promoter for over ten years. These farmers also have consistently not been in their communities enough for them to be effective promoters. Furthermore, World Vision lost its funding so it was unable to provide sufficient follow up to the farmers. This follow up could have helped promoters be more able to reach their neighbors than was observed.

6.1.1.1 Recommendations

- A. Revisit these same communities in five years with a similar study to determine if more farmers have adopted S/A consistent with Buckles *et al.*'s (1998) 10 year predictions
- B. Conduct research with all the promoters trained by World Vision in Veraguas to determine if similar patterns emerge or if our observations are isolated
- C. Work with agencies to provide consistent follow up activities to their trained farmers. This should involve various agencies and address each partner's strengths. Some agencies (World Vision/IDEAS) are good trainers, while others are good at extension. One example would be to collaborate with agencies such as U.S. Peace Corps or JICA (Japanese Peace Corps) that send workers into a community for 2-4 years. These workers can do the follow up training with the promoters that World Vision/IDEAS is unable to do in order to better support the farmers

6.1.2 Objective 2: Describe Patterns of and Reasons for Slash and Burn as Well as Sustainable Agriculture use in the District of La Mesa, Veraguas

This study observed that there exist many more S/B farmers than S/A farmers. This is somewhat troubling due to the fact that agencies have been in many of these communities for a number of years. Furthermore, compared to other studies, the observed number of adopters is low. A variety of factors combined could explain these observations. A dependence on tradition, as well as farmers waiting to see results of S/A seem to play a major role in S/A non-adoption for this area. This could also be a result of agencies not being able to communicate the benefits of S/A such as improved harvest.

The reasons given for adoption/ non-adoption are useful for a couple of reasons. First they describe the reality that farmers encounter. While tradition, for example, may seem trivial, it does matter to the farmer making that decision. In the case of the S/A farmers, reasons given for adoption can help agencies “sell” the techniques to future S/A farmers. If they know that S/A farmers adopt to improve harvest, then they can use this reason as a selling point. Understanding and acknowledging these reasons can help agencies work more respectfully and efficiently with these farmers.

Finally a potential indicator of future adoption emerged in this study. Since adopting S/A requires that farmers must incorporate changes into their farms, the ability to incorporate changes could be a sign of things to come. If S/B farmers begin to incorporate little changes, such as planting in rows as opposed to random planting, this shows that they are open to break from traditional practices. Agencies should target these farmers for future training.

6.1.2.1 Recommendations

- A. Increase the level of communication between adopting farmers and non-adopting farmers through workshops, field trips, technical days
- B. Develop strategic plans that incorporate the top reasons both S/A and S/B farmers give for land use
- C. Incorporate traditional ways of life into projects goals
- D. Target farmers who are incorporating change into their current practices.
- E. From a research point of view: Interview more farmers in other communities where World Vision or any other agency has worked to statistically validate our observations
- F. Use the top four reasons as a tool for in-depth statistical analysis in order to validate our observations
- G. Look at incorporation of change as a possible indicator for future S/A adoption

6.1.3 Objective 3: Describe Barriers that Inhibit Sustainable Agriculture Adoption

This may be the most useful information to support agencies as it highlights some of the weaknesses of the current system. As mentioned above, agencies have been involved in many of these communities for a number of years. As a result, most farmers are familiar with the techniques of S/A, yet few are adopting. Perhaps the most troubling barrier that was mentioned was that farmers felt that their land was inappropriate for S/A. In conversations with S/A farmers, development workers and fellow researchers, almost all agreed that S/A can be used on any type of land and soil. This fact has also been demonstrated in the literature. Yet, S/B farmers interviewed in this study expressed the contrary.

If S/A is promoted appropriately, then there should be little reason for farmers to feel that their land is inappropriate or that they lack the appropriate technology. On the contrary, appropriate technology, (technology easily found on local farms) should be used to promote these techniques. It was observed in many of these communities that agencies have not been following this rule so eloquently put forth in Bunch's landmark book *Two Ears of Corn* (1982). While agencies may feel they are meeting an immediate food need through introduction of mechanized agriculture, they fail to realize the long term damage created by introducing inappropriate technology.

Again, knowing the barriers that farmers face in the adoption of S/A can be an invaluable tool to S/A promotion. As described above, it highlights weaknesses of agency extension efforts. This enables future agencies to learn from past mistakes, so that they do not continue to reinvent the wheel.

6.1.3.1 Recommendations

- A. At all times use appropriate technology and demonstrate new approaches on land similar to the land owned by the targeted audience.
- B. Do community assessments to understand community history, goals and needs before implementation of the project
- C. Work these goals and needs into the project objectives
- D. Work with farmers to integrate new techniques into their farms at their own pace and liking
- E. Look for alternative and realistic S/A techniques to be incorporated, not necessarily optimal
- F. Have strong farmer input during every phase of the project

- G. Continued research in more communities in Panamá using the top four barriers/reasons given for adoption in order to quantify results and validate observations of this study

6.1.4 Objective 4: Describe the Benefits/Costs of S/A Adoption

Understanding farmer-described benefits of S/A adoption provides valuable information to researchers and agencies. Knowing that the farmers in this study are enjoying better harvests, have less farm-related work, and report overall improved livelihoods confirms what many studies in the literature have described. It also provides proof that the system does indeed work. This proof can then be shared with non-adopters who are interested, but are waiting to see results first.

Costs associated with beginning S/A may contribute to the low adoption rates observed. Many farmers are not in a situation to assume the increase in labor needed to initiate S/A into their farms. Knowing this can help agencies develop creative solutions to help farmers invest the initial labor associated with these techniques.

6.1.4.1 Recommendations

- A. Use the benefits listed to develop strategic plans that highlight the farmer-perceived benefits to S/A integration
- B. Take advantage of local traditions such as the *junta* in promoting S/A techniques.

The *junta* tradition brings the entire community together to work on a person's farm, with the requirement that that farmer will participate in *juntas* held by other farmers. This can lessen the work load, as the entire community will show up to do the work, as opposed to one farmer.

6.2 FINAL CONCLUSION

Is replication of agriculture techniques the only measure of success for these promoters? Many of these promoters are active leaders in their communities. They have visions and plans for their communities' development, and the community looks to them for guidance. All of these promoters credit the training provided by World Vision as the reason for their position in these communities. They also have been very active in bringing other projects to their respective communities. One promoter I visited was organizing community members to bring electricity to the community. Another was leading a project to build a community center. This very same promoter organized twenty persons to participate in the focus group interview during our visit. This was done on very short notice. This almost never happens in Panamá, which demonstrates his effectiveness as a leader.

While it would be easy to take the observed adoption numbers and declare World Vision's efforts a failure, it would be a great disservice to these communities to do so. If communities are following these leaders in various projects that benefit the overall community, it is only a matter of time before they follow their leaders in agriculture practices. By implementing some of the following recommendations, agencies and researchers can help communities follow their promoters' agricultural lead. Finally, future research should build upon the observations generated by this study to provide more in-depth information about adoption/non-adoption patterns in Panamá.

APPENDIX A: INTERVIEW QUESTIONS

1.0 Agency questions

(questions were asked in Spanish, the English translation is provided for ease of replication in other regions of the world)

1. What are your project's goals?
2. How are these goals being met?
3. How do you measure the attainment of these goals?
4. What are your training methods?
5. Do you use a training farm?
6. Do you visit farmers on their farms?
7. How do you recruit farmers to participate in your program?
 - i. What criteria do you use?
8. How are trainings sessions structured?
 - i. -Length, techniques utilized, focus on technical or leadership development
9. Are there follow up trainings?
10. How long is the training period?
11. If you do follow up training with the farmers, for how long to you offer support?
12. What incentives do you use for keeping farmers interested?
13. How are farmers transported to the training site?
14. Do you provide supplies/seeds etc to farmers?
15. What is expected of farmers once they complete the project?
16. How is that enforced?
17. How many farmers have you trained over the last xx years?
18. What follow up measures have you taken:
 - i. To encourage continued involvement by the farmers
 - ii. To monitor their continuance and its level of success
 - iii. To monitor if the practices are spreading to other farmers.
19. Have you performed a Participatory Rapid Appraisal (PRA) in communities in which you have worked?

2.0 Farmer Interview Questions:

These questions were asked to both S/A farmers and S/B farmers and broken up into several categories:

Farm based questions:

1. How many hectares (ha) do you farm?
2. How many ha does you and your family own?
3. What do you plant?
4. How do you plant?
5. Do you plant trees? What kind?
6. What do you use the harvest for?
7. Do you own livestock?
8. How many ha pasture land do you own?

9. How do you determine the land you will set aside for pasture?
10. How do you prepare the land before you plant?
11. If you burn the fields, how many ha do you burn and how often?

Questions to establish opinions of current system:

1. Why do you currently use the system you are using?
2. What benefits do you gain from this system?
3. What are drawbacks to this system?
4. Have you added new techniques/crops to your system since you learned the technique?
5. If so, why?
6. What major challenges do you face in trying to improve your farming production?
7. What keeps you from adding on additional techniques, crops?
8. What are future plans for your farm? Both short term and long term.
9. For non-adopters: Sr. Fulano uses these sustainable agriculture techniques, what is your general opinion of these techniques?

Socio-Economic:

1. What do you do with the harvest?
2. How would you describe the market conditions?
3. What difficulties do you encounter in bringing excess harvest to market?
4. Do you have outside sources of non-farm related income?
5. How many are in your family? Where do the kids go to school?¹
6. What are the road conditions?
7. Where are the main sources of income?
8. How have things/conditions changed over the last five years? Last ten?
(includes population, crop harvests, road conditions, education, community activities)
9. What are the population demographics?
10. Male/female, age
11. Where is the nearest market to sell harvests and how is the harvest transported to this market?

Environmental Conditions:

1. How long is the rainy season?
2. Over the years, has annual rainfall changed in amount and or distribution?
3. How have the harvests been compared to previous years?
4. How do you meet the energy needs of the house for cooking, etc?
5. Where do you obtain these materials?
6. How does this compare to previous years?
7. What are your farm plans for future years?
8. Do you use any chemical fertilizers, pesticides etc?

Community Questions: ²

1. How big is your community?
2. What groups exist?
3. What is group participation like?
4. What proportion of community members people are farmers?
5. What proportion of community members own, rent, squat land?
6. Are there many peones (laborers) available for doing work on the farm?
7. What are the community goals and immediate needs?
8. How are outside agencies working towards realizing these goals?
9. What are the sanitary conditions?
10. How big are the schools, and do students travel for secondary education?
11. What agencies are working with these communities?
12. What are some of the community problems/issues and how do they affect the community?
13. What are some of the positive aspects of the community?

Farmers Education background:

1. What is your highest level of education?
2. What seminars, projects have you participated in?
3. What did you learn in these seminars?

4.2 Interview Questions for S/A Farmers:

Questions to establish a pre-innovation history of techniques utilized:

1. What traditional agriculture techniques did you utilize before adopting your current agriculture techniques?
2. How long did you rely on these traditional techniques?
3. Where did you learn these traditional techniques?
4. Are there any other agriculture techniques that you have used but have not mentioned?
5. What have you done to improve your farm over the last 5 years? Last 10?

Questions to establish use of agriculture techniques learned in training and how long they have been used:

1. Where did you learn these agriculture techniques?
2. If you learned these techniques on a training farm, what has kept you from using more of the techniques on this farm?
3. How long have you utilized the current techniques?
4. Where did you learn these techniques?
5. How have you modified these techniques since you learned them?
6. Why have you modified these techniques?

7. How has the integration of these new techniques impacted your farm and life?
8. Have you seen any changes in soil, etc. since incorporating these techniques?
9. How does that compare to your former techniques?

Questions for assessing amount of farmer to farmer extension:

1. What are your neighbor's perceptions of the techniques you are using?
2. Have you shared any of your techniques with your neighbors?
3. If so, which ones?
4. How did you share these techniques?³
5. Were you compensated for these services?
6. Have you followed-up with these neighbors?
 - a. When?
 - b. How?
7. In your opinion, why do people choose not to utilize the techniques you are using?

Questions for assessing extension activity by development agencies in the community:

1. Which groups have worked with you from outside the community?
2. How active are they?
3. How can they be better?
4. What support do they provide?
5. Is there a group you wished worked in this area?

¹ This question is to establish economic pressures in the loss of labor and the additional cost in sending kids away for secondary education

² To be asked of individuals and in groups in the community

³ To assess active or passive extension

APPENDIX B MAPS OF PANAMÁ AND VERAGUAS

2.

REPUBLICA DE PANAMA PROVINCIA DE VERAGUAS

SEGUNDO DE LOS MAPAS CENSALES DE 1961, REPRODUCCION POR
LA SECCION DE CARTOGRAFIA, MINISTERIO DE ESTADISTICA
Y CENSO DE LA COMISION MEXICANA DE LA REPUBLICA

Simbolos

	Carretera
	Rio
	Lago
	Monte
	Pueblo
	Aldea
	Hacienda
	Escuela
	Iglesia
	Cementerio
	Monumento
	Fortaleza
	Faro
	Estacion
	Puente
	Barragem
	Canal
	Carril
	Linha de energia
	Linha de telefone
	Linha de telegrapho
	Linha de cable
	Limite
	Linha de costa
	Ilha
	Recife
	Lagoa
	Bahia
	Estreito
	Cabo
	Ponto
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	Istmo
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APPENDIX C: TOP REASONS BY CATEGORY

Category	Top four responses
Why use S/B	Tradition, prefers work, land issues, faster immediate yields
Why not use S/A	Land issues, lack of interest, waiting for results, too much work
Barriers to S/A (asked to both S/B and S/A farmers)	Too much work, too expensive, land issues, lack of appropriate equipment
Reasons for using S/A	Improved harvests, enjoyed the work, improve local environments, forced to change due to poor land conditions
S/A techniques used	Rice tanks, soil conservation techniques, tree plantations, organic fertilizers and pesticides
Benefits to S/A	Better harvests, improves soil and environment, Improved livelihoods, use less land and seed
Direct impacts of S/A	Improved harvests, improved livelihoods, off-farm employment related to S/A training, less farm-related work

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