

kef
commission for development studies
at the austrian academy of sciences

PROMOTING BIODIVERSITY CONSERVATION IN CAMBODIA – Cambiodiversity (161) –



Assessment Report



2009

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CONTENT

INTRODUCTION	4
Interviews	4
Review activities	7
ASSESSMENT RESULTS: INTERVIEWS	7
Reasons for the predominance of rice in Cambodia	8
Background information to explain the current situation	8
Use of rice in Cambodia	9
Cultivation of non-rice crops	10
Obstacles or barriers towards further diversification of Cambodian agriculture	10
Incentive factors that could promote diversification	11
Substitute crops to rice	12
Ideas, models, strategies, or approaches to promote increased agro-diversity	13
ASSESSMENT RESULTS: LITERATURE REVIEW	14
Ranked reason for rice predominance	14
Ranked main reasons for cultivating non-rice crops	15
Main barriers to further diversification	16
Main substitutes to rice	19
Main ideas and suggestions for encouraging non-rice alternatives	19
ANNEX:	25
GUIDELINES FOR THE INTERVIEWS	25

INTRODUCTION

The project Cambiodiversity is jointly carried out by the Vienna based Organisation for International Dialogue and Conflict Management (IDC), the Austrian University of Natural Resources and Applied Life Sciences (BOKU) and the Cambodian Royal University of Agriculture (RUA), with a funding from the Commission for Development Studies (KEF).

Cambiodiversity addresses the issue of rice predominance in Cambodia's agriculture and investigates the feasibility and ways for further agro-diversification. It hereby puts particular emphasis to the social, economic, political and ecological aspects and pays special attention to the interests, needs and concerns of farmers.

Assessment activities present a central part of the project Cambiodiversity. They have included on the one hand a series of interviews with farmers, as well as with other relevant stakeholders, and, on the other hand, the review of publications dealing with rice cultivation and biodiversity in Cambodia.

Interviews

A total of 180 Interviews with farmers took place between September and December 2008 in several Cambodian provinces. (Fig.1). In addition, 60 interviews have been conducted with technical staff and policy makers, chiefly including representatives from the district-level Ministry of Agriculture in the provinces.

Table 1.

Locations and number of interviews conducted with a representative of a farm household in 12 provinces of Cambodia.

Province	Districts per Province	Name of Districts	Respondents per Province
Battambang	7	Ek Phnom; Sang Ke; Bor Vil; Thmor Kol; Mong Reussey; Battambang; Ratana Mondol	15
Kampong Speu	3	Samrong Torn; Phnom Sruoch; Korng Pisey Trapeang Thom; Dang	15
Kampot	4	Torn; Kpg Trach; Banteay Meas	15
Kandal	3	Saang; Mouk Kampoul; Pognealoeu	15
Kpg Cham	5	Tbong Khmum; Tam Be; Chamcar Leu; Kpg Siem; Prey Chhor	15
Kpg	3	Kpg Chhnang; Rolea Pha	15

Province	Districts per Province	Name of Districts	Respondents per Province
Chhnang		Ear; Kpg Leng	
Kpg Thom	3	Stong; Prasat Sambo; San Touk	15
Kratie	3	Sam Bo; Chhlong; Sluol	15
Prey Veng	4	Kpg Leav; Peam Ro; Preas Sdach; Kpg Tra Bek	15
Ratanakiri	1	O Chhum	15
Siem Reap	2	Puok; Banteay Srey	15
Stung Treng	2	Siem Bok; Thala Boravath	15
Total			180

The 12 provinces where interviews with representatives of farming households were conducted included:

- Seven lowland provinces, where rainfed rice agriculture dominates (Battambang, Kampong Chhnang, Kampong Speu, Kampong Thom, Kandal, Prey Veng and Siem Reap),
- Four upland provinces, where more diversified agricultural practices are common (Kampong Cham, Kratie, Ratanakiri and Stung Treng)
- and a single coastal province (Kampot).

The names of each district in which households were selected for interview are given in Table 1, while their approximate location within Cambodia is shown in Fig. 1.

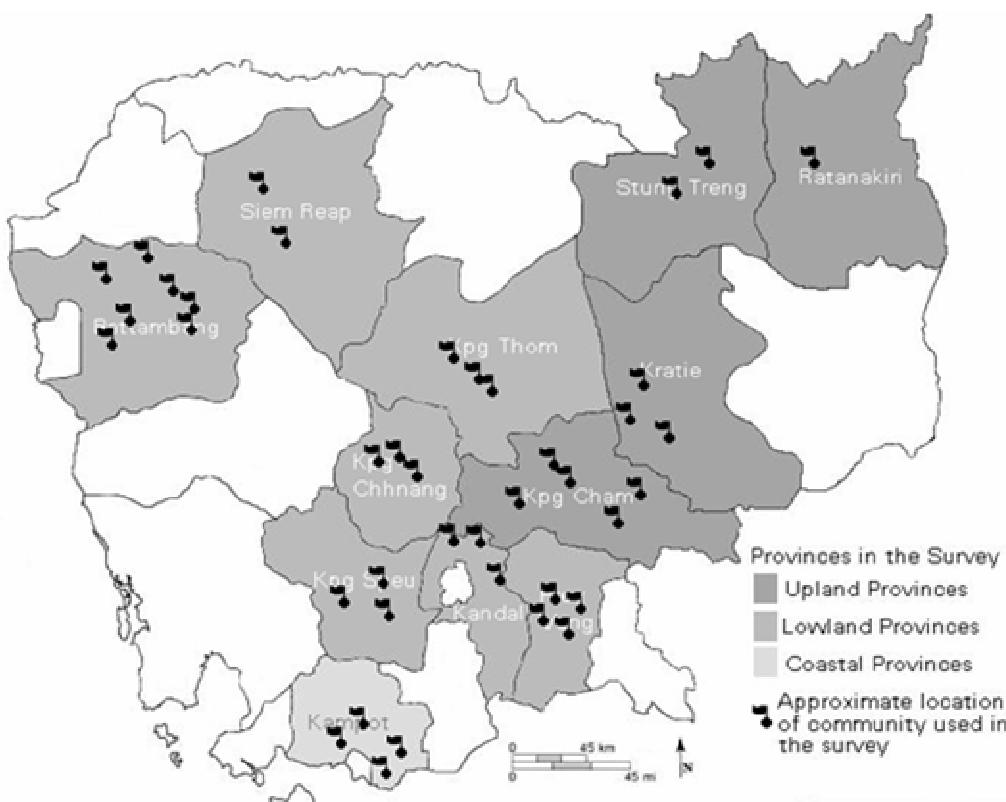


Fig. 1. Approximate location of the district in the 12 provinces where interviews with representatives of farming households took place. (map by Sophal Chuong)

Methodology behind location and respondent selection and interviewing

The RUA team was composed of the following researchers:

- Mr. Chuong Sophal, Dean of the Faculty of Agronomy;
- Mr. Ro Sophaon Rith, Lecturer at the Faculty of Agronomy and project assistant;
- Mr. Ly Tyneth, forth year B.Sc. student, Faculty of Agronomy; and
- Mr. Preap Madora, forth year B.Sc. student, Faculty of Agronomy.

The twelve provinces were selected on the basis of agro-ecosystem (i.e. upland, lowland and coastal) in order to guarantee a fairly good representation of Cambodia as a whole.

Subsequently the director of the Provincial Department of Agriculture of each selected province was contacted. The objective of the project was explained to the director, who was then asked to provide background details on the agricultural situation and history of the province, and hence to point out authorities that could facilitate interviews with farmers, as well as technical staff and policymakers that could be used for interviews.

Within the provinces, the selection of districts and then communities was done at random. In every district, four to five households per commune were asked for interview. To ensure the representativeness of the data collected, it was decided to conduct a total of 15 interviews with farmers in every province, making a total of 180 interviews for all 12 selected provinces.

The conduction of interviews with policy makers and technical staff was often retarded due to the often busy agendas of these stakeholders and the difficulty to fix appointments. In total, 29 policy makers have been interviewed.

Additional interviews have been carried out with 31 researchers, scientists and staff from international and non governmental organizations.

All interviews were conducted using the predetermined interview guide. While few of the interviews posed any major problems, it was evident that many farmers were often reluctant to provide family information, possibly because they had negative experiences with similar types of surveys. After the objectives of the research were made clear to the farmers, however, it was generally very easy to discuss with them information, views and opinions relevant to the research.

Review activities

For the review, the two students, Mr. Ly Tyneth and Mr. Preap Madora, as well as the dean, Mr. Chuong Sophal, contacted the relevant libraries at the relevant ministries, academic institutions or NGO/GOs. Subsequently, documents related to crop production in Cambodia, to agricultural history, to past and recent crop production, agricultural market, agricultural policy, constraints and strategies to circumvent constraints were selected. Often, access to literature was difficult and unfortunately, not much could be borrowed.

In total, 34 publications have been reviewed, of which:

- 11 Scientific publications and documents;
- 18 Reports by national and international institutions;
- 2 Policy texts
- 2 Journal Articles
- 1 Project/ Conference Report

The results from the review have been summarized in the project's Assessment Report.

ASSESSMENT RESULTS: INTERVIEWS

Cambodian agriculture is dominated by subsistence or semi-subsistence smallholdings. Rice is the predominant crop, with currently about 81% of agricultural land being devoted to rice cultivation (MAFF 2009) and any increases in total agricultural output closely mirroring increases in rice production. The farmer survey results corroborate the predominance of rice in all regions of Cambodia: Eighty-three percent of all surveyed farmers cultivated rice, although 41% of respondents combined rice cultivation with at least one other non-rice crop, while 17% grew a non-rice crop exclusively.

With rice comprising more than 75% of the average daily calorie intake of Cambodians, and Cambodia only becoming self sufficient in rice at a national level in 1999 after decades of importing rice, it is only recently that Cambodia has really attained a position that allows it to move away from promoting rice cultivation for food security to start considering an increased variety of non-rice crops for better nutritional security and diversified income generation.

However, regular flooding during the wet season in the low-lying, densely-populated areas around the Great Lake and other waterways that form the heartland of Cambodian agriculture, combined with the predominance of poorly productive sandy and acidic soils, mean that large swaths of traditional agriculture land, while suitable for rainy season rice cultivation, are not well suited to many other crops. Additionally, inadequate extension services and knowledge transfer from research to Cambodian farmers often mean that farmers cannot capitalise on potential market niches or best practice technologies for non-rice crops. This results in rice retaining a dominating position in Cambodian agriculture, although the projects and programmes aimed at diversifying Cambodian agriculture are gradually gaining momentum.

Reasons for the predominance of rice in Cambodia

In terms of respondents' answers about why they themselves were cultivating rice or their opinions on why rice was generally so predominant, all respondent gave (1) the need to grow rice for household consumption as the main reason. Several respondents explained that apart from just being the usual and long-established thing to do, growing their own rice was cheaper than buying it from the market. Ninety-eight percent of respondents also gave the fact that rice could (2) easily be sold as a second reason for cultivating rice, often elaborating that they perceived the market for rice to be more stable than that of many or most other non-rice crops, simply because there would always be a demand for rice, whereas this was not guaranteed for other crops. Fifty-one percent of respondents further stated that rice was also grown because it was (3) easy to manage in terms of pests and diseases. Having cultivated rice for many generations, Cambodian farming households have extensive experience with rice cultivation and hence also feel confident about being able to appropriately manage any pest and diseases situations that may arise. With other, newer crops, on the other hand, they lack this confidence. Twenty-three percent of respondents lauded the (4) easy storage properties of rice, stating that they did not need to worry about elaborate post harvest facilities or activities when cultivating rice, while this was certainly the case with some other, more perishable crops. Finally, 22% of respondents noted the (5) value of rice straw and husks for feeding cattle and pigs, often part of the farming system. Other crops that did not produce such a by-product often necessitated the buying-in of extra animal feed.

Background information to explain the current situation

On a national scale, the predominance of rice is rooted in historical, cultural/traditional, political, economic and agro-ecological reasons.

Historical, cultural and traditional: Khmer farmers have been growing rainfed rice for at least 2,000 years (possibly longer in the case of upland rice), while irrigated rice production technologies were first introduced along trade routes from India about 1,500 years ago (Chandler 1993; Nesbitt 1997). During the Angkor era (9th-14th Century), elaborate irrigation systems were constructed which reportedly allowed up to three rice harvests per year (Pillot 2007), and the economic power of Angkor was rooted in rice agriculture. This perceived importance of rice has retained its predominant position in the Cambodian culture and tradition. Every year after harvest, for example, Cambodian farmers celebrate the "Dalean" Ceremony to give thanks to the land and the ancestors for granting a good rice harvest, while the Royal Ploughing Ceremony early in the year is used to predict rice yields for the coming season.

Politically and economically: Economically and politically, rice too has played and plays a crucial role in Cambodian society. A large proportion of the population is currently directly dependant on rice yields for its livelihood, both in terms of subsistence and/or for income, and food security in Cambodia is closely associated to rice production. When, after nearly four years of Khmer Rouge misrule, Cambodia rice harvests failed in the late 1970s and early 1980s, for example, the country was plunged into rampant and devastating famine, a phenomenon that gnawed itself deep into the Cambodian psyche. Accordingly, the strategy of various succeeding governments has always focussed on increasing rice production as a means to feed the population. Indeed, although with more land put under rice and gradual gains in rice productivity, Cambodia became self-sufficient in rice on a national level about a decade ago, strong regional disparities exist in food or rice security, with year-to-year performances also being variable.

Agro-ecologically: Finally, the predominant agro-ecological conditions in the most populated areas of Cambodia lend themselves well to rice production. The regions around the main water bodies on the central plains, especially in the Great lake (Tonle Sap) basin, are home to almost 90% of Cambodians, and it is these regions where the lion share of Cambodian agriculture is practised. Much of this area, in turn, is either dominated by sandy plain soils of relatively poor fertility or subject to periodical inundation. While many rice varieties and species, as well as many common or traditional rice cultivation systems used by Khmer farmers, are adapted to such conditions, these conditions restrict the use of many other crops that are sensitive to waterlogging or require higher soil fertility to flourish, etc.

Use of rice in Cambodia

The primary use for the rice grown by farmers in Cambodia is for subsistence: almost half (47%) of all the farming households interviewed grew rice exclusively for household consumption or stored as seed for the next season. Nevertheless, 53% of interviewed households sold the rice that exceeded household subsistence, and on average just under a quarter (23%) of rice grown by all surveyed farmers was sold. These figures are slightly higher than estimates by Ngo & Mund (2006) who put the proportion of rice consumed for subsistence in Cambodia at 60-65% of overall output, and considerably higher than a recent report by the Ministry of Agriculture, Forestry and Fisheries, which put the proportion of rice used for household subsistence at 50% (MAFF 2009).

In terms of seasonal variations in rice use, a relatively higher proportion of rice grown during the dry season is used commercially than that of rice grown over the rainy season.

Regional differences between the amount of rice that is consumed for subsistence or sold ostensibly also relate back to the seasonal differences. Our interview data, for example, indicated that the proportion of rice used for subsistence was virtually identical among smallholder farmers of the lowland and upland regions (77%), regions where farmers sometimes sow dry season rice in addition to rainy season rice, but that this marginally lower when compared to proportion of rice used for subsistence in the coastal province of Kampot (86%), where farmers almost exclusively grow shallow water rice in the rainy season.

Rice varieties: The farmer survey indicates that smallholder farmers rarely use a different variety of rice explicitly for sale than that sown for consumption, although as

part of a strategy to reduce risks and to distribute labour, many farmers do plant several rice varieties in the same field in separate small plots. While a high proportion of less commercial rainy-season rice varieties are traditional, estimates from 2004 put about 70-80% of the dry-season cultivated areas are under high-yielding varieties, which are often imported from Vietnam (FAO 2004).

Cultivation of non-rice crops

Non-rice annual crops account for a little over 12% of the cultivated area according to recent MAFF (2009) data, often being grown in more fertile upland areas. Many Cambodian farmers grow vegetable on a small-scale in plots near their house for household consumption or local sale. Soybean, on the other hand, is the most important non-rice crop in terms of area planted, while pulses in general are the most important group of upland crops. Maize in turn is the most important non-rice cereal crop and is grown for cash rather than as a subsistence crop. Together with soybean and mungbean, maize accounts for almost 4% of the total cultivated area of Cambodia. Cassava is the most important root crop in Cambodia with an annual production of approximately 30,000 t. Rubber is the most important perennial crop, grown mainly on red-black upland soils, and both cassava and rubber cultivation have enjoyed strong growth in recent years. In terms of cultivated area under fruit trees, cashew, banana, coconut, mango, citrus fruits and jackfruit are the most common. Bananas are grown in all provinces, but Kampong Cham and Kampot are the largest producers of bananas for export. Cashew nuts are grown mainly in Kampong Cham and Kampong Thom Provinces, while the largest coconut cultivation occurs in Kandal and Kampot Provinces and the Kampot and Takeo Provinces are the largest producers of mango. Durian, longan, sapodilla and star apple are also cultivated on small areas, usually in home or village gardens throughout the country. Asked about their opinions about why non-rice crops were being grown, all respondents agreed that such crops were used to complement household consumption and/or for sale, while 53% stated that some non-rice crops were also grown because of the relative short duration from planting to harvesting, and 5% said that non-rice crops were either good for soil fertility or for health and were hence grown for these reasons.

Obstacles or barriers towards further diversification of Cambodian agriculture

From the point of view of surveyed farmers, mainly obstacles to increasing the proportion of non-rice crops are centred on the relative difficulty or unfamiliarity with cultivating various non-rice crops. Nearly all interviewed farmers (97%) stated that with non-rice crops there were more problems with insect and disease attack than compared to rice, while 13% elaborated that increasing climatic vagaries, to which rice was less susceptible, exacerbated the situation with respect to pest and disease incidence. In consequence, farmers did not feel confident enough in the relevant pest and disease control strategies to risk growing new and unfamiliar crops. Indeed, 62% of respondents stated that they did not know enough about appropriate cultivation techniques or systems for non-rice crops, and hence felt it would be risky to grow them.

Another salient point made by 94% of respondents was that they perceived the market for alternative crops to be insufficiently strong or stable compared to that for rice. Even if a certain crop attracted a high farm gate price in one year, many respondents felt the demand could change from one instant to another and prices

could drop at harvest time the following season, heightening the risk of changing from one crop to another, especially given the investments necessary to do so. Thirteen percent of respondents also gave the lack of an appropriate local processing industry for non-rice crops as a barrier to diversification, which undoubtedly contributed to the perception that markets for non-rice products were less lucrative and arguably less stable market. Indeed, several interviewed knowledge gatekeepers or policy makers concurred that the relative dearth of appropriate processing facilities for various crops and products meant that Cambodia exported agricultural products in a raw or semi-raw state to neighbouring Vietnam or Thailand, thereby losing out on the opportunity of value-adding to products and thereby making the respective industries more lucrative, if not also potentially less volatile.

A further barrier to increasing the proportion of non-rice crops is related to the fact that the rainy season is used mainly to grow the rice necessary for household subsistence, hence leaving the dry season as the only real window to plant other crops. The relative dearth of irrigation, however, limits off-season non-rice production, a point made by 87% of respondents, while unrestricted livestock grazing during the dry season, which is common especially in Kampong Speu Province, actually destroyed fields of non-rice crops, 18% of respondents lamented. Finally, 18% of respondents also claimed that there was a lack of external incentives in terms of seeds and equipment donations for them to be able to attempt crop diversification.

Policies, programmes and projects to overcome the barriers

The MAFF's Agricultural Sector Strategic Development Plan 2006-2010 promotes the concept of diversifying the Cambodian agricultural sector. It is built around a multitude of tenets, one, for example, being a focus on attracting foreign or national investment in agroprocessing industries, while another especially emphasises the use of IPM to overcome pest and disease challenges in susceptible non-rice crops, a third is based on strengthening research capacity and extension of new techniques and a forth being the enhancement of irrigation systems throughout the country (MAFF 2005). Ostensibly as part of this strategy, too, the MAFF cooperates with the meteorological bureau to augment irrigation from the Chinit River in Kampong Thom Province, for example, while the Cambodian Agricultural Research and Development Institute (CARDI) produces seed for tomato, beans and cassava, which it distributes to farmers as part of trials it conducts on farmers' fields. Cambodia's leading agricultural NGO, CEDAC, also distributes seed to farmers and undertakes farmer field trials in various provinces of Cambodia, while CEDAC and another agricultural NGO, the Peri-Urban Agriculture Centre (PUAC), assist farmers with finding markets for their products. In the CEDAC model, CEDAC buyers visit farmers to buy product directly from them, while PUAC creates regional centres that wash and prepare vegetables for transport and sale in the city, relying on farmers that live close by to bring their vegetables to the centres.

Incentive factors that could promote diversification

Points of view from interviewed stakeholders

Interviewed knowledge gatekeepers from NGOs and the Provincial Departments of Agriculture maintained that the main factors that could help promote agricultural diversification include the extension of appropriate technology packages to farmers, an increase in effective irrigation and drainage systems, interventions to agricultural markets to stabilise prices for important crops, the formation of farmers associations, and, according to some interviewed field extension officers, an increase in soil fertility.

In terms of extension, it was noted that there should be more direct contact between government extension officers and farmers, as basically most extension was being undertaken by NGOs, especially CEDAC. For the improvement of irrigation and drainage systems, interviewees emphasised that there was especially also a need to maintain existing infrastructure, as much was being rundown. Markets and price stabilisation, on the other hand, could be achieved through an assortment of different approaches. For example, if downstream processing industries are created and supported, they can boost and stabilise demand for products that have potentially become more durable. The government states that attracting foreign and/or private sector investment to build a stronger agroprocessing industry is a priority, but it is difficult to generalise what is actually happening in this respect, as licences, concessions or tax breaks are treated highly individually and without much transparency, without a standard set of rules being applied to all potential investors. Another means of enhancing the attractiveness of the market for non-rice crops put forward by respondents was through the government regulating prices, either of inputs or by instigating price floors for the actual produce. The formation of farmer associations, in turn, could improve collective bargaining power to achieve discounted input and farm gate sale prices, as well as rationalising input purchases and potentially circumventing the need for middlemen that swallow a substantial part of potential profit. Various NGOs and OIs are actually working on the fomenting increased farmer associations and cooperatives around the country. In terms of enhancing soil fertility and thereby allowing a broader range of crops to be cultivated, extension officers suggest that new methods and approaches for integrated soil fertility management, especially also involving organic fertilisers, should be researched and extended to farmers. This too is being done mainly by NGOs, such as CEDAC.

Farmers' opinions on factors that could promote diversification

Asked for ways that would stimulate them to plant more non-rice crops, 99% of smallholder farmer respondents suggested a subsidised or improved seed and tool supply. In fact, 42% of interviewed farmers had actually received seeds from the CEDAC, CARDI, collaborative research projects or NGOs. Improved markets, especially in terms of government efforts to stabilise prices were suggested by 92% of smallholder respondents as a way to promote diversification in cropping, and 22% of smallholder respondents actually had received assistance in locating appropriate markets for non-rice products, mainly through NGOs like CEDAC or PUAC, which functioned as intermediaries between quality-conscious urban markets and farmers. While 83% of respondents felt that more demonstrations and training in methods and techniques for growing non-rice crops would help to increase their share in Cambodian agriculture, just over half of respondents admitted that they had received training from MAFF or NGOs in non-rice crop cultivation. Better support of irrigation maintenance by the government or NGOs was deemed a potential incentive for non-rice crop cultivation by 74% farmer respondents, while 13% also advocated the higher availability of rural credits to buy seed or necessary equipment.

Substitute crops to rice

In fertile upland areas, rice can be substituted with various cash crops, such as maize, soybean, cassava, rubber, sesame, etc. However, although some upland soils derived from basaltic parent material are very fertile, much of the elevated plain areas

of Cambodia are relatively sandy and not particularly fertile. Cash crop productivity, already restricted by the length of the dry season, is therefore often not very high.

In lowland areas, which are periodically inundated, options for the wet season are more limited, while dry season cultivation depends on irrigation. Vegetable, which generally have a high market demand, can be grown near the house instead of rice in a place that does not waterlog. The main crop that farmers grow instead of rice is taro because it is tolerant to periodical flooding.

Trials, projects and initiatives of substitute crops to rice

There are numerous organisations that are facilitating research and the trialling of various non-rice crops throughout Cambodia. Among these are the universities, research institutes and agricultural colleges that undertake trials of vegetable or other crops continuously in various areas of Cambodia, with the aim of being able to produce best-practice principles and guidelines for farmers. CEDAC, which has an extensive network of leader farmers and extension agents, around several provinces of Cambodia, similarly trials various non-rice crops and appropriate fertility management options, as well as handing out seed or planting material to farmers that subscribe to their organic cultivation conditions. CARDI and the Directorate General of Agriculture under MAFF, too, trial various crops and hand-out appropriate seed, etc., as do the French-CIRAD spearheaded Project for Diversification of Agriculture in Cambodia (PDAC), which is trialling and extending various upland crops and cover crop cultivation techniques centred on zero-till in Kampong Cham, Pailin and Battambang Provinces, the French NGO PUAC based just outside Phnom Penh, the environmentally-focussed NGO GERES, CARE, Srei Khmer, the Apsara Authority with its trial fields close to Siem Reap, the East-West Seed Company, which also advertises many non-rice crops, and many more NGOs and GOs.

Would farmers accept to partly substitute rice with other crops, and under what conditions?

In general, 43% or 22% of farmer respondents said that they could imagine replacing rice with beans or vegetables, respectively. The necessary conditions to catalyse an increased share of these crops to be grown by farmers are similar to the suggestions that farmers put forward for general crop diversification under Point 7, namely subsidised or improved seed and tool availability for beans and vegetables, improved markets with more stable prices for such crops, more demonstrations and training in methods and techniques for growing non-rice crops, more irrigation and increased support with irrigation maintenance, and easier access to rural credits to buy seed or necessary equipment.

Ideas, models, strategies, or approaches to promote increased agro-diversity

The Ministry of Agriculture, Forestry and Fisheries (MAFF) has set up a series strategy papers and blueprints to enhance agro-diversity in Cambodia, that are being implemented to varying degrees. These include:

MAFF Master Plan May 2006

MAFF strategy to develop the agricultural sector. October 2005

MAFF action plan to develop the agricultural sector in Cambodia. 2001

MAFF strategy for agriculture and water. January 2007.

MAFF strategy to improve market information. September 2005.

The World Bank, too, has released a strategy paper on agriculture for development in Cambodia that gives ideas for the diversification of Cambodian agriculture.

10. Projects to support the diversification of Cambodian agriculture

As alluded to under Point 8, there are many NGO, GO, and IO that are devoted to trialling various non-rice alternatives throughout Cambodia, but also to a certain extent to extending advice on how to cultivate the crops to farmers, as well as distributing seed, planting material or other inputs to farmers. Indeed, among our farmer sample population, 54% had received training from MAFF or NGOs in non-rice crop cultivation, although 83% stated more would be better, while 42% of farmers had actually received seeds from CEDAC, CARDI, collaborative research projects or NGOs. Some NGOs and IOs also devote effort to catalysing the formation of farmer cooperatives and associations, as is the case with the German Genossenschafts und Raiffeisenverband or the national NGO Buddhism for Development, or help in bringing non-rice markets to farmers, as is the case with project and initiatives by CEDAC, PUAC, or the Greenbelt Project in Siem Reap Province, spearheaded by the German Development Cooperation, for example. Indeed, 22% of smallholder respondents actually had received assistance in locating appropriate markets for non-rice products.

ASSESSMENT RESULTS: LITERATURE REVIEW

During the literature review, RUA students were given the opportunity to analyse relevant publications about biodiversity and rice cultivation in Cambodia. While bringing in interesting inputs and complementary data for enriching the information collected during the interviews, these activities presented an interesting and instructive exercise for the involved students. Apart from an analytical approach and the collection of information and data on the role of rice and current possibilities for and obstacles to agro-diversification in Cambodia that were considered in the assessment analysis, students were also asked to develop a more quantitative approach and to document if the issue is addressed in Cambodian and international literature, what topics are mostly covered and what answers are mainly given to the questions raised within the project.

These outcomes are shown below.

Types and numbers of publications and literature reviewed

- Scientific publications and documents : 11
- Reports by national or international institution : 18
- Project or conference reports : 1
- Policy texts : 2
- Journal articles : 2

Ranked reason for rice predominance

For Food

- [1]: (Page: 1, 10, 19, 163, 171, 173, 188, 189, 298, 331)
- [2]: (Page: 1, 21, 91)
- [4]: (Page: 5)
- [6]: (Page: 15, 26)
- [13]: (Page: 1)
- [15]: (Page: 1, 2)
- [19]: (Page: 1, 4, 8)
- [21]: (Page: 40, 49, 63)

- [27]: (Page: 5, 6, 48)
- [33]: (Page: 15)

For Sale

- [1]: (Page: 9, 10, 11, 19, 173, 189, 299, 338)
- [2]: (Page: 32, 91)
- [6]: (Page: 25, 26)
- [13]: (Page: 1, 36, 44)
- [17]: (Page: 2)
- [19]: (Page: 8)
- [21]: (Page: 40, 45)

Easy to cultivate and good environmental conditions for growth

- [1]: (Page: 87)
- [2]: (Page: 23)
- [6]: (Page: 3)
- [14]: (Page: 14)
- [15]: (Page: 1, 2, 6)
- [27]: (Page: 48)

Long time storage ability

- [1]: (Page: 287)
- [6]: (Page: 26)
- [15]: (Page: 2)

Market available

- [1]: (Page: 324)
- [2]: (Page: 31)
- [22]: (Page: 4, 5, 6, 7)
- [29]: (Page: 2)

Can be used for fodder

- [1]: (Page: 166, 334, 335)
- [18]: (Page: 14)
- [28]: (Page: 91, 92 ,93, 94, 95, 96, 97, 98, 99, 100, 101, 102)

Ranked main reasons for cultivating non-rice crops

Family consumption

- [1]: (Page: 181, 188, 190, 191,)
- [2]: (Page: 36, 38, 47, 49, 51, 54, 91)
- [9]: (Page: 20, 38, 45, 47, 59, 63)
- [11]: (Page: 7, 11)
- [13]: (Page: 27, 46)
- [21]: (Page: 49)
- [34]: (Page: 18, 20, 21, 23, 24)

To increase family income

- [1]: (Page: 163, 171, 176, 181, 190, 191)
- [2]: (Page: 36, 38, 42, 47, 49, 51, 54, 91)
- [4]: (Page: 5)
- [9]: (Page: 20, 25, 28, 40, 45, 47, 58, 61, 63)
- [11]: (Page: 7, 11)
- [13]: (Page: 27, 46)
- [14]: (Page: 17, 22)
- [15]: (Page: 5)
- [16]: (Page: 44)
- [21]: (Page: 60)
- [34]: (Page: 18, 19, 21, 23, 24)

Shorter duration

- [9]: (Page: 20, 27, 38, 45, 69)

Soil fertility improving

- [1]: (Page: 172, 174, 207)
- [15]: (Page: 5)
- [34]: (Page: 19)

Health reasons

- [1]: (Page: 180, 190)
- [34]: (Page: 18, 23, 24)

Main barriers to further diversification

Crop pests and diseases

- [1]: (Page: 174, 183)
- [6]: (Page: 4, 21, 23, 35, 37)
- [7]: (Page: 30)
- [13]: (Page: 27)
- [14]: (Page: 13)
- [17]: (Page: 7)
- [18]: (Page: 13)

Lack of irrigation and drainage systems

- [1]: (Page: 164, 183)
- [2]: (Page: 74, 75, 105)
- [3]: (Page: 16, 17)
- [6]: (Page: 4, 13, 21, 27, 34, 35)
- [7]: (Page: 19, 20, 21, 30, 54, 109)
- [8]: (Page: 15)
- [9]: (Page: 2, 19, 110)
- [10]: (Page: 5)
- [11]: (Page: 11)
- [13]: (Page: 2, 23, 26, 27, 33, 45)

- [14]: (Page: 13)
- [16]: (Page: 9, 15, 45)
- [17]: (Page: 7)
- [18]: (Page: 13)
- [21]: (Page: 61, 63)
- [24]: (Page: 24)
- [31]: (Page: 9, 13)
- [34]: (Page: 3, 41, 46, 90, 98, 99, 100)

Lack of suitable production techniques

- [2]: (Page: 76, 77)
- [6]: (Page: 21, 23, 25, 26, 27, 34, 37, 40)
- [7]: (Page: 18, 19, 21, 40, 52, 56, 57, 109, 115)
- [8]: (Page: 15)
- [9]: (Page: 2, 19, 110, 113)
- [13]: (Page: 26)
- [14]: (Page: 13)
- [21]: (Page: 61)
- [24]: (Page: 24)
- [34]: (Page: 3, 30, 90)

Market problem

- [1]: (Page: 164, 171)
- [2]: (Page: 8, 57, 58, 77, 78, 80, 81, 87, 104, 105)
- [3]: (Page: 22, 23, 44)
- [5]: (Page: 11, 12, 13, 14, 18, 20)
- [6]: (Page: 4, 21, 25, 27, 41)
- [7]: (Page: 18, 20, 110)
- [8]: (Page: 14)
- [9]: (Page: 3, 19, 23, 24, 25, 26, 29, 32, 34, 36, 41, 42, 43, 50, 51, 55, 56, 57, 61, 62, 65, 66, 67, 71, 72, 73, 74, 110, 111, 112, 114, 117)
- [10]: (Page: 5, 8)
- [12]: (Page: 19, 20)
- [13]: (Page: 2, 30)
- [14]: (Page: 4, 6, 13)
- [16]: (Page: 15, 37, 38, 45)
- [21]: (Page: 61)
- [22]: (Page: 2, 3)
- [25]: (Page: 3)
- [29]: (Page: 3)
- [31]: (Page: 13)
- [33]: (Page: 19)
- [34]: (Page: 30, 81)

Lack of food processing capability for easily perishables products

- [2]: (Page: 8, 78, 104)
- [5]: (Page: 8)
- [6]: (Page: 21, 25, 26, 35, 37, 41)
- [8]: (Page: 14)

- [9]: (Page: 2, 19, 23, 24, 25, 26, 29, 32, 33, 35, 36, 41, 42, 43, 51, 57, 66, 67, 72, 73, 74, 110, 113, 114)
- [24]: (Page: 24)

Unrestricted grazing (social problem)

- [1]: (Page: 164)
- [2]: (Page: 69, 70, 104, 105)
- [5]: (Page: 1)
- [6]: (Page: 23, 25, 26, 39, 40)
- [7]: (Page: 20, 21, 52)
- [8]: (Page: 14)
- [9]: (Page: 5, 113)
- [11]: (Page: 8)
- [12]: (Page: 22)
- [13]: (Page: 2, 26)
- [14]: (Page: 13)
- [34]: (Page: 31)

Unpredictable climate

- [1]: (Page: 164, 182)
- [2]: (Page: 73, 74)
- [6]: (Page: 4, 21)
- [7]: (Page: 20, 21, 30, 57)
- [9]: (Page: 29, 45,)
- [11]: (Page: 12)
- [13]: (Page: 27)
- [16]: (Page: 9, 15, 19, 45)
- [17]: (Page: 7)
- [18]: (Page: 13, 14)
- [22]: (Page: 2)
- [24]: (Page: 24)

Input price and availability

- [2]: (Page: 76, 77, 79, 80, 104)
- [3]: (Page: 16, 17, 25)
- [5]: (Page: 8)
- [6]: (Page: 13, 21, 23, 37, 39, 40, 41, 104, 115)
- [7]: (Page: 19, 20, 30, 42, 52, 57)
- [9]: (Page: 2, 3, 4, 10, 19, 24, 25, 26, 32, 33, 34, 36, 41, 42, 43, 44, 45, 50, 52, 55, 58, 61, 62, 66, 67, 71, 72, 73, 74, 111, 112, 114, 132)
- [10]: (Page: 5)
- [12]: (Page: 20)
- [13]: (Page: 2, 3, 26, 30)
- [14]: (Page: 6, 22)
- [16]: (Page: 45)
- [17]: (Page: 7)
- [21]: (Page: 46, 47, 61)
- [31]: (Page: 11)
- [34]: (Page: 31, 41, 90, 105, 106)

Soil problem

- [6]: (Page: 21, 23, 35, 37)
- [7]: (Page: 19, 20, 54)
- [10]: (Page: 5)
- [13]: (Page: 26, 27)
- [14]: (Page: 13)
- [16]: (Page: 19)
- [31]: (Page: 11)
- [34]: (Page: 3, 90, 92, 93, 95, 96)

Main substitutes to rice

Vegetables

- [11]: (Page: 4, 9)
- [13]: (Page: 40)

Beans

- [9]: (Page: 123, 125, 126, 128, 145)
- [10]: (Page: 4)
- [13]: (Page: 40)
- [19]: (Page: 4)
- [21]: (Page: 62)
- [25]: (Page: 11)

Cash crops

- [9]: (Page: 123, 125, 126, 127, 128, 145)
- [10]: (Page: 4)
- [13]: (Page: 40)
- [19]: (Page: 4)
- [21]: (Page: 60, 62)
- [25]: (Page: 11)

Fruit trees

- [13]: (Page: 40)

Main ideas and suggestions for encouraging non-rice alternatives

Provide technical training for growing non-rice crops

- [1]: (Page: 171)
- [2]: (Page: 2, 10, 20, 55, 79, 84, 85, 86, 90, 91, 92, 94, 99, 100, 103, 106)
- [3]: (Page: 19, 36)
- [5]: (Page: 7, 8)

- [6]: (Page: 13, 16, 17, 18, 19, 22, 23, 25, 34, 35, 41)
- [7]: (Page: 3, 5, 28, 29, 34, 50, 56, 57, 58, 59, 69, 111, 113, 114)
- [8]: (Page: 2)
- [9]: (Page: 2, 4, 9, 110, 113, 130)
- [13]: (Page: 30)
- [14]: (Page: 2, 3, 7, 17)
- [18]: (Page: 45, 46)
- [20]: (Page: 81)
- [23]: (Page: 14)
- [28]: (Page: 3)
- [29]: (Page: 6)
- [30]: (Page: 13)
- [31]: (Page: 10, 11)
- [34]: (Page: 71, 91, 136)

Provide irrigation for non-rice crops

- [2]: (Page: 20, 84, 90, 103, 104, 105)
- [3]: (Page: 17)
- [6]: (Page: 13, 16, 22, 34)
- [7]: (Page: 3, 4, 7, 12, 23, 25, 27, 28, 29, 30, 33, 38, 39, 40, 47, 50, 51, 52, 54, 55, 56, 58, 59, 60, 71, 103, 105, 106, 109, 111, 114, 123, 124)
- [8]: (Page: 12)
- [11]: (Page: 13)
- [14]: (Page: 12)
- [16]: (Page: 9)
- [18]: (Page: 45, 52, 55)
- [28]: (Page: 3)
- [29]: (Page: 6)
- [30]: (Page: 13)
- [31]: (Page: 10, 11)
- [33]: (Page: 9)
- [34]: (Page: 71, 76, 77, 78, 79, 80, 91, 98, 101, 135)

Improve market for non-rice products

- [2]: (Page: 2, 55, 79, 86, 91, 92, 93, 106, 107)
- [3]: (Page: 17, 22, 23, 36)
- [5]: (Page: 7, 8, 9, 20, 21, 22, 23, 24, 25, 28, 29, 31, 32, 39, 40, 41, 53, 54, 55, 65, 66, 67, 68)
- [6]: (Page: 16, 17, 19, 26, 34)
- [7]: (Page: 23, 25, 26, 30, 34, 37, 38, 47, 48, 49, 50, 51, 57, 70, 101, 105, 106, 109, 110, 112, 114, 123)
- [8]: (Page: 19)
- [9]: (Page: 2, 4, 5, 9, 10, 110, 111, 113, 130, 131, 132, 133)
- [10]: (Page: 6)
- [11]: (Page: 4)
- [14]: (Page: 2)
- [17]: (Page: 1)
- [18]: (Page: 45, 46)
- [20]: (Page: 83)
- [26]: (Page: 1)
- [29]: (Page: 6)

- [30]: (Page: 13)
- [31]: (Page: 10, 11)
- [32]: (Page: 46, 47)
- [34]: (Page: 71, 81, 82, 91, 137)

Provide more and better tools and materials

- [1]: (Page: 172)
- [2]: (Page: 2, 20, 55, 84, 85, 86, 90, 91, 95, 97, 103, 105, 106, 107)
- [3]: (Page: 17, 19)
- [5]: (Page: 7)
- [6]: (Page: 16, 17, 18, 19, 20, 22, 25, 26, 28, 35, 39, 41)
- [7]: (Page: 3, 5, 6, 23, 25, 26, 27, 28, 29, 30, 34, 38, 39, 47, 49, 51, 55, 56, 59, 60, 70, 109, 110, 112, 123)
- [8]: (Page: 2)
- [9]: (Page: 9, 10, 111, 130, 131, 133)
- [10]: (Page: 6)
- [13]: (Page: 30)
- [14]: (Page: 6, 12, 17, 22, 23, 30)
- [18]: (Page: 45, 46)
- [20]: (Page: 81, 82)
- [26]: (Page: 1)
- [28]: (Page: 3)
- [29]: (Page: 6)
- [31]: (Page: 10, 11)
- [34]: (Page: 134, 135)

Provide Credits

- [2]: (Page: 2, 55, 84, 85, 91, 97, 105)
- [3]: (Page: 19)
- [6]: (Page: 16, 40)
- [7]: (Page: 30, 37, 49, 50, 51, 106)
- [8]: (Page: 19)
- [9]: (Page: 10, 11, 112, 132)
- [14]: (Page: 15)
- [18]: (Page: 46, 57)
- [21]: (Page: 26)
- [31]: (Page: 10, 11)
- [34]: (Page: 71, 119, 135, 136)

Promote the creation of farmers associations

- [1]: (Page: 172)
- [2]: (Page: 2, 86)
- [6]: (Page: 23, 25, 40)
- [7]: (Page: 5, 30, 46, 51, 60)
- [8]: (Page: 18)
- [9]: (Page: 2, 11, 110, 132)
- [10]: (Page: 6)

Provide more and better food processing techniques

- [1]: (Page: 172)
- [2]: (Page: 55, 93, 94, 103, 106, 107)
- [3]: (Page: 23, 24)
- [6]: (Page: 17, 22, 23, 35, 41)
- [7]: (Page: 6, 25, 30, 34, 37, 38, 48, 49, 50, 51, 57, 58, 109, 112, 114)
- [8]: (Page: 18, 19)
- [9]: (Page: 2, 4, 8, 9, 10, 110, 113, 130, 131)
- [14]: (Page: 2, 17, 22)
- [18]: (Page: 46)
- [20]: (Page: 81, 82)
- [29]: (Page: 6)
- [31]: (Page: 10, 11)
- [34]: (Page: 71)

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ANNEX:**Guidelines for the Interviews****- 1 – GUIDELINES FOR THE CONDUCTION OF INTERVIEWS****The Project in General:**

The project Cambiodiversity is intended to deal with the issue of biodiversity in Cambodia. It aims on the one hand at analysing the current predominance of rice in the Cambodian agriculture sector and identifying the major reasons for this concentration. On the other hand, it aims at assessing the possibility and conditions for further diversification and paving an appropriate and sustainable way towards a more diversified agriculture.

The expected final outcomes of the Cambiodiversity project are therefore:

1. A **comprehensive set of information** and data reflecting
 - the major reasons for the rice predominance in Cambodia's agriculture
 - the main barriers to further agro-diversification
 - the main positive factors that may promote and foster agro-diversification
 - what crops would be most appropriate to complement rice as primary crop
 - ⇒ These information should increasingly reflect the interests, attitudes and expectations from Cambodian farmers.
2. A set of **recommendations for major stakeholders** (policy-makers, decision takers, scientists, NGOs, extension workers), as well as for farmers to show them how they could contribute to further diversification of Cambodian agricultural system
3. Moreover: Encourage and foster enhanced **networking and exchange with other countries from the region** (as well as from Europe) to benefit from their experience, knowledge and capacities in the field of agro-diversification and conservation of biodiversity.

To achieve these outcomes, the interviews will serve to reflect the opinion, interests and knowledge of farmers, as well as provide additional information of scientists/researchers/ international organisations and of national policy makers. This is on the one hand to complement and found the data and facts collected during the review

and assessment activities, and on the other hand to prepare the subsequent elaboration of recommendations.

The purpose of the interviews is

- to get information on the reasons and conditions for rice cultivation in Cambodia;
- to collect information on perceptions, experience and attitudes of farmers concerning the cultivation of rice;
- to assemble the knowledge and information of scientific and political stakeholders;
- to collect information on the disposition, conditions and probability of further diversification of Cambodia's agriculture, as well as the way it could be achieved

Questions to be addressed by the interviews and answered by the collected information

? WHAT ARE THE MAJOR **REASONS** THAT EXPLAIN THE PREDOMINANCE OF RICE IN CAMBODIA'S AGRICULTURAL SECTOR?

- ? Reasons of farmers
- ? Reasons from agronomical point of view
- ? Political/ Economic reasons

? WHAT ARE THE MAIN **BARRIERS** TO FURTHER DIVERSIFICATION?

? WHAT **POSITIVE FACTORS** MAY OR EVEN DO ALREADY SUPPORT AND PROMOTE ENHANCED AGROBIODIVERSITY IN CAMBODIA?

? WHAT **CROPS** WOULD BE BEST ADAPTED TO COMPLEMENT RICE AS MAIN STAPLE CROP AND CONTRIBUTE TO PROMOTE AGROBIOVERSITY?

? WHAT **AREAS/ REGIONS** IN CAMBODIA WOULD BE BEST ADAPTED?

Who should be interviewed?

- **FARMERS:** Farmers with small, medium and large farms who cultivate rice and/or other crops for family and/ or commercial purposes;
- **SCIENTISTS:** Researchers from Universities who work on issues related to the cultivation of rice (agronomy, economics and trade, etc...)

- OTHER RESEARCHERS: Researchers from national or international researchers institutes or organisations (National or international projects,...)
- STAFF FROM INTERNATIONAL OR FOREIGN ORGANISATIONS (ex. UN and UN Organisations, GTZ, DED, World Bank, NGOs,...)
- NATIONAL POLICY MAKERS: notably policy makers, civil servants, etc... familiar with policies, regulations, conventions, that affect the cultivation of rice and Cambodia's agriculture in general (ex. In ministries, national agencies, local authorities, etc...)

Instructions for the conduction of interviews:

- FARMERS:
 - Please try to interview farmers with farms of different sizes (small, medium, large size)
 - Please try to interview farmers who primarily cultivate rice and some that do cultivate other, non-rice crops
 - Please try to interview also women
- SCIENTISTS AND POLICY MAKERS:
 - You can also add more open questions to the questionnaires: give them the possibility to explain and comment the situation, to share their view, if they accept.
- Take **notes of all answers** as comprehensively and exact as possible OR use a tape **recorder** if available
- NB: **The proposed questions are indicative:** Please feel free to adapt them if requested by the situation (ex. Interviewed persons wants to address an issue not initially considered. Ex: If a person does not want to talk on a specific point, then address other relevant aspects!) If you consider it necessary and interesting to add some more questions or to modify a question, feel free to do so.

- 2 – QUESTIONNAIRE WITH SUGGESTED QUESTIONS

The table below provides for every group of interviewed persons (Farmers/ Scientists/ Policy-makers) a list of suggested questions and some additional explanations and comments. Please feel free to adapt these questions, if needed and appropriate.

INTERVIEWED PERSONS	SUGGESTED QUESTIONS	COMMENTS & REMARKS
1) FARMERS :	<p>1. What crops do you cultivate this year (define “year” for Cambodia)? If possible, estimate how many hectares and what percentage of cultivated area.</p> <p>a. Rice:</p> <ul style="list-style-type: none"> - water rice - dry cultivation <p>b. What major non-rice crops:</p> <p>2. Which crops are grown for</p> <ul style="list-style-type: none"> - own consumption - exchange / barter trade - profit ? <p>3. From where do you get the seeds? (e.g. market, extension worker, last yield,)</p> <ul style="list-style-type: none"> a. for rice b. for non-rice crops <p>4. What are the main reasons for cultivating rice? Please comment the answer and give additional information and examples.</p> <p>4a. What is the tradition of cultivating rice?</p> <p>4b. What are the market opportunities for rice, compared to non-rice crops? Please give examples</p> <p>4c. For which crops do you get subsidies from the government?</p> <p>4d. Do you consider cultivating rice as particularly secure or efficient for a</p>	<ul style="list-style-type: none"> • Ad1: Let him/her make a list of all crops he/she cultivates • Ad2: Let him/ her explain for what purpose rice and other crops are grown. • Ad3: Collect information on seed supply in Cambodia. • Ad4: Collect and discuss the main reasons and incentives for rice cultivation. • Please give for every question a (brief) response. • Leave the interviewed person enough time for explaining and giving additional details, examples and comments. • Let him tell you short stories, for instance how he goes to the market, what problems he encounters in the

	<p>successful harvest every year?</p> <p>4e. What crop has ever been affected by pests or diseases so that your harvest was destroyed? Please comment.</p> <p>4f. From where do you get knowledge and experience in cultivating rice or cultivating other crops?</p> <p>4g. What are your major reasons for cultivating rice?</p> <p>– What are the major reasons for cultivating other, non-rice crops?</p> <p>5. Do you remember if in this area other crops than rice have been cultivated before?</p> <p>If yes when and what crops?</p> <p>What were the main reasons for dropping these crops? Has there been any intensification of the cultivation of rice since then?</p> <p>6. Do you consider growing other crops (additionally to rice) as a chance or as a risk?</p> <p>→ chance, e.g.: more market opportunities, better rotation, less exposure to diseases or pests, promoting soil fertility, balanced nutrition</p> <p>→ risks: less subsidies, growing possibilities during rainy seasons, lacking experience & knowledge, access to seeds,</p>	<p>cultivation of rice and other crops, about traditions and past experiences, etc...</p> <ul style="list-style-type: none"> • Ad5: Discuss the experience in the region with non-rice crops. <p>NB: In case, there has never been cultivation of non-rice crops in the area, then please discuss for what major reasons not.</p> <ul style="list-style-type: none"> • Ad6: Assess his perspective and position towards growing rice or growing non-rice crops. <ul style="list-style-type: none"> • Ad7: What are the plans for the future?
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	<p>7. Perspectives for the future: Do you expect over the next 10 years to grow more rice, less rice or the same amount of rice? Or what other plans for the future? e.g. quit agriculture.</p>	
<p>2) SCIENTISTS: = approx. 10-20 persons</p>	<p>1. What are the main reasons for the predominance of rice in Cambodian Agricultural Sector?</p> <p>2. Are there plans/ initiatives to further diversify the Cambodian agriculture, for instance by the government?</p> <p>3. What are the main barriers towards strengthening the cultivation of non-rice crops?</p> <p>4. From agricultural point of view: Would it be feasible to substitute parts of rice cultivation by growing other crops? What crops? What region, provinces would be most appropriate? And for what reasons?</p>	<p>WHAT SHOULD BE ASSESSED:</p> <ul style="list-style-type: none"> - Reasons for rice predominance from his/her point of view - Context of possible diversification: is it officially planned? What are the major problems and difficulties? Is it possible, with regard to the Cambodian agricultural specificity (climate, soil,...) <p>⇒ You can make quite open interviews: - Try to provide information on the above mentioned points but - Give interviewed person enough time and possibility to comment and detail and to address issues not covered by the interview guideline, if relevant for the project.</p>
<p>3) POLICY MAKERS: = approx. 10-20 persons</p>	<p>1. What are the main priorities of the Cambodian Agrarian Policy over the next years? What are the plans and prospects for the rice cultivation?</p>	<p>WHAT SHOULD BE ASSESSED:</p> <ul style="list-style-type: none"> - Political and Economic Context of current rice predominance in Cambodia - Context of possible diversification: is it officially planned? What are the

	<p>2. Are there plans/ initiatives to further diversification of the Cambodian agriculture? If yes, please explain and comment.</p> <p>3. What are the main barriers for strengthening the cultivation of non-rice crops?</p> <p>4. What is the government doing to promote biodiversity and the protection of biodiversity in Cambodia? (Subsidies, Conferences, Training, Programmes, Regulations, ...)</p> <p>5. How is the communication and exchange between government and farmers organised? (exchange of information, requests, questions...)</p>	<p>major problems and difficulties? Is it possible with regard to the Cambodian agricultural specificity (climate, soil,...)</p> <ul style="list-style-type: none"> - Information on the exchange and communication between the Government/ local authorities and the farmers <p>⇒ You can make rather open interviews that help to provide information on the above mentioned points.</p> <p>⇒ Give interviewed person enough time and possibility to comment and detail and to address issues not covered by the interview guideline, if relevant for the project.</p>
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