

# 添付資料 3 - 2

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*UNAH* 自主ワークショップメモ



ホンジュラス国 首都圏における地すべり対策能力強化支援  
GIS 講習会メモ

原 崇 (JICA コンサルタントチーム)

開催場所 : IHCIT 3F 講義室、UNAH

参加者 : 9-11 名 (ワーキンググループメンバー)

講師 : Mr. Alex Cardona, GIS and Watershed Management Engineer, IHCIT-UNAH

講習会のスタイル : PPT を使った座学的な講習ではなく、DEM データや画像データを使った演習方式。1-3 人に 1 台の PC を割り当て、参加者が講師からの指示や解説を受けながら自分たちで操作し演習する。使用ソフトは Arc GIS 10.2。いずれも午前中 9 時から 12 時までの半日の講習であった。

### 【1 日目】

#### <講習内容>

- ・ Arc GIS の基本的機能解説 — 作業に入る前の必要な機能の解説及び設定
- ・ 画像データの標定づけ (ジオリファレンス)

予め講師側で用意した講習用のデータを用いて、全くの ArcGIS 初心者である参加者に、ArcGIS へ画像データやファイルの読み込み方、Tool Box の機能、座標系について説明した。その後、Google Earth から地すべり対象地区 Reparto 周辺の画像データを切り取り、それを ArcGIS に取り込み、ジオリファレンスの仕方を指導。

一通り講師が作業手順をプロジェクターで映しながら説明を行い、その後参加者に各自で Berrinche 地区のジオリファレンスを実習をさせた。

#### <感想>

参加者は AMDC からの GER や UMGIR、UNAH の学生、UPI から参加していた。彼らは ArcGIS を扱うのは初めてであり、それぞれ講師が説明する作業手順をメモしながら熱心に受講していた。初日の作業にはかなり時間をかけていた。参加者も講習について行けていたようである。

### 【2 日目】

- ・ 傾斜区分図の作成

講師側で用意した DEM データを用いてコンター図作成、TIN でラスターデータに変換し標高図を作成した。それを基に傾斜区分図を作成した。作業では 3D analyst や Spatial Analyst の機能を用いた。

#### <感想>

GIS 機能を使った解析手法の講習であったが、参加者は途中質問をしながらも講習についていていた。またこれらの解析で作成した標高図や傾斜区分図を実際にどういったケースで使われるのかについて GIS 解析結果の活用事例も紹介していたので参加者の理解を促すのに役立っていたと思われる。

### 【3日目】

- ・ 任意の条件をクリアする 2 点間の最適ルート検出
- ・ 地すべりのボリューム計算

DEM 上に設定した任意の 2 点間の最適ルートを検出する解析を行った。この最適ルートは任意の条件を満足させるものであり、講習で設定された条件は、傾斜区分図と土地利用図で定義されている「平坦地」と「私有地」を避ける、というものである。

ここでの地すべりのボリューム計算とは、Surface Difference 機能を用いて、現地形の TIN データと地すべり箇所だけ切り取った TIN データの差のボリュームを算出することであるため、正確には地すべりブロックのボリューム計算ではない。

#### <感想>

これまで行ってきた講習の応用編という位置づけであり、ここまで参加者も ArcGIS の作業に慣れてきて、またこれまでの講習で付けていたノートを見ながらも各自実習を行っていた。ただ、これらの作業の方法についてはある程度理解は進んだようであるが、いざ自分たちで考えて作業を出来るようになるためにはまだ十分ではないと思われる。現時点では ArcGIS に慣れたという程度であるが、短期専門家の技術移転での作業で ArcGIS を使うときにいきなりまごついて手も足も出ないと言いはなさそうである。



ホンジュラス国 首都圏における地すべり対策能力強化支援  
空中写真判読講習会メモ

桑野 健 (JICA コンサルタントチーム)

日時 : 2015 年 8 月 13 日 (木) 9:00-12:00、14 日 (金) 9:00-12:00

開催場所 : IHCIT3F 講義室、UNAH

講師 : Mr. Rigoberto Moncada López ほか

参加者 : 14-15 名 (ワーキンググループメンバー)

No.	名前	所属	13 日	14 日
1	Oscar Elvir	IHCIT-UNAH	○	
2	Nelson Sevilla	IHCIT-UNAH	○	○
3	Alex J. Cardona	IHCIT-UNAH	○	○
4	Lidia Torres	IHCIT-UNAH	○	○
5	Erick Salgado	IHCIT-UNAH	○	○
6	Elisabeth Espinoza	UNAH	○	○
7	Carlos José Sánchez	UNAH (Faculty)		○
8	Aníbal Godoy	IGH-UPI		○
9	Ana Natarén	UPI	○	○
10	Javier García Reynaud	Universidad Pedagógica Nacional (UPNFM)	○	○
11	Karen Cubas	GER-AMDC	○	
12	Eneyda Rodríguez	GER-AMDC	○	○
13	José Alberto Pinto	GER-AMDC	○	○
14	Francisco Bustamante	GER-AMDC	○	○
15	Marcio López Estrada	GER-AMDC		○
16	Marco R. Fúnes	UMGIR-AMDC	○	○
17	Susan Molina	Environmental Management AMDC (UGAM)	○	○

講習会のスタイル : 授業形式の講習ではなく、実際の空中写真を使った演習方式。1-2 人に 1 台の実態視鏡 (JICA 供与品) を割り当て、参加者が講師からの指示や解説を受けながら自分たちで判読を行い、判読図 (案) を作成した。いずれも午前中 9 時~12 時までの半日の講習であった。

### 【8/13】

#### <講習内容>

- ・ 8月の自主開催WSのスケジュール説明（今週：空中写真判読、次週：現地調査、次々週：結果デジタイズ）（Ms. Lidia）
- ・ ワーキンググループメンバーの追加・確認（Ms. Lidia）
- ・ PPT資料（廣田さんの資料）を使った説明（Mr. Rigoberto）
- ・ 実体視境による演習

コンサルタントチームで用意したパイロットサイト（El EdénとNueva Santa Rosa）空中写真（印刷版）を用いて、参加者に対して、写真判読をさせた。まずは Rigoberto氏がPPT資料を使って基礎論を説明した後、各自が実体視境を用いて判読を行った。講師はRigoberto氏のほか、Aníbal Godoy氏（2日目のみ）、すでに写真判読を概ね理解しているUNAH講師（Oscar Elvir、Lidia Torres）、コンサルタントチーム桑野が行い、参加者の不明点に応えたり、判読のコツなどを説明した。

#### <感想>

参加者はAMDCからのGERやUMGIR、UGAM（環境部）、UNAHの学生、UPI、UPNFMから参加していた。参加者のほとんどが写真判読を実施するのは初めてであり、当初の説明だけではよく理解していなかったようであるが、実際に実体視境を使い地形が立体的に見えたときには歓喜を上げるなど喜んでいた。その後も、各人が実体視を続けたことによって、理解が深まったようである。

### 【8/14】

- ・ 実体視境による演習
- ・ 次週WS（現地調査）の内容協議
- ・ 前回のArcGIS WSの受講証書の手渡し

昨日の続きで空中写真の上にトレーシングペーパーを重ねて、パイロットサイトの地すべり、谷地、崖部、河川などをトレースした。最終的に参加者全員が各自の地すべり判読図を完成させた。終盤では次週WSで具体的にどのような作業を行うか、協議が行われた（次週の現地調査では各自が作成した判読図（案）を現場に持参し、現地確認を行うこととなる）。

また最後に、前回のArcGIS WSの受講証書を参加者に手渡した。

#### <感想>

2日間、十分に時間をかけて空中写真判読のトレーニングを行ったことから、参加者は写真判読の意義や実施方法を理解したと思われる。

（次頁写真）







ホンジュラス国 首都圏における地すべり対策能力強化支援

現地調査講習会メモ

桑野 健 (JICA コンサルタントチーム)

日時：2015年8月20日(木) 8:00-12:00、21日(金) 8:00-12:00

開催場所：El Edén (8/20) と Nueva Santa Rosa (8/21)

講師：Mr. Anibal Godoy ほか

参加者：17-19名 (ワーキンググループ (WG) メンバーほか)

No.	名前	所属	20日	21日
1	Lidia Torres	UNAH-IHCIT	○	○
2	Nelson Sevilla	UNAH-IHCIT	○	○
3	Alex Cardona	UNAH-IHCIT		○
4	Elisabeth Espinoza	UNAH	○	○
5	Ana Natarén	UPI	○	○
6	Javier García Reynaud	UPNFM	○	○
7	José Alberto Pinto	AMDC-GER	○	○
8	Eneyda Rodríguez	AMDC-GER	○	○
9	Marcio López Estrada	AMDC-GER	○	○
10	Francisco Ramón Bustamante	AMDC-GER	○	○
11	Susan Molina	AMDC-UGA	○	○
12	Marco R. Fúnes	AMDC-UMGIR	○	○
13	Juan José Jiménez	AMDC-Regioplan	○	○
14	Vera S. Véliz	AMDC-Regioplan	○	○
15	Freddy Flores	AMDC-Regioplan		○
16	Mario Antonio Aguilera	AMDC-Regioplan		○
17	Oscar Amílcar Pavón	AMDC-CODEM	○	○
18	José Rolando Borjas	AMDC-CODEM	○	○
19	Aníbal Godoy Vásquez	IGH	○	
20	Rigoberto Moncada	Assistant to JCT	○	○

講習会スタイル:最初に Anibal 氏が状況の説明を若干行った後、参加者は2班に別れて、それぞれのグループが斜面の状況、クラックの位置、建物の変形などのチェックを行った。調査途中では講義や説明などは特になく、参加者 (WG メンバー) が自分たちで話し合いながら進めていた。調査方法などで不明な点があるごとに、JCT (桑野) に質問するなどとはしていたが、終始、自分たちだけで現地調査を進めていた。

## 【8/20】

### ＜講習内容＞El Edén

- ・ 現地状況の説明（Mr. Aníbal）
- ・ 地すべり状況調査・建物被害調査

UNAH-IHCIT が用意したパイロットサイト（El Edén と Nueva Santa Rosa）空中写真（印刷版）と各自の判読図（案）を用いて現地調査を実施したほか、住民へのアンケート表による被害状況・地すべり発生時状況の聞き取り調査を行った。参加者のうち、El Edén を担当する WG に所属する者は地すべり地内で調査を行い、Nueva Santa Rosa を担当する WG は地すべり周辺での調査を行った。

### ＜感想＞

現地の地すべりを初めて訪れた参加者もいたことから当初は調査がうまく進まないのではと危惧したが、参加者同士で話し合いながら（分かるものが分からないものに指導しながら）ほぼすべての調査を WG だけで実施することができたことはすばらしい。

ただ、図面上へのクラックや段差、湧水などの記載方法が統一的でなく、また十分に記載できていない参加者もいたことから、継続的な指導が必要と思われる。

## 【8/21】

### ＜講習内容＞Nueva Santa Rosa

- ・ 地すべり状況調査・建物被害調査

昨日の続きで Nueva Santa Rosa を担当する WG に所属する者は地すべり地内で調査を行い、El Edén を担当する WG は地すべり周辺での調査を行った。また2日間で30～40世帯程度の住民聞き取り調査を行ったようである。

### ＜感想＞

炎天下の中、参加者全員が最後まで積極的に自分たちで現地調査を行ったことで、調査の流れを十分に理解できたものと思われる。全体の流れを理解したので、今後は変状それぞれの着目点や記載方法などを技術移転することが望ましい。

また両日とも警察が同行しており、住民とのトラブルなどは一切なかった。

（次頁写真）





ホンジュラス国 首都圏における地すべり対策能力強化支援

判読図デジタル化講習会メモ

桑野 健 (JICA コンサルタントチーム)

日時 : 2015 年 8 月 27 日 (木) 9:00-12:00、28 日 (金) 9:00-12:00

開催場所 : IHCIT3F 講義室、UNAH

講師 : Mr. Rigoberto Moncada

参加者 : 15 名 (ワーキンググループ (WG) メンバー)

No.	名前	所属	27 日	28 日
1	Lidia Torres	UNAH-IHCIT	○	○
2	Nelson Sevilla	UNAH-IHCIT	○	○
3	Alex Cardona	UNAH-IHCIT	○	○
4	Maynor Ruiz	UNAH-IHCIT	○	
5	Elisabeth Espinoza	UNAH	○	○
6	Ana Natarén	UPI	○	○
7	Javier García Reynaud	UPNFM	○	○
8	José Alberto Pinto	AMDC-GER	○	○
9	Eneyda Rodríguez	AMDC-GER	○	○
10	Francisco Ramón Bustamante	AMDC-GER	○	○
11	Marco R. Fúnes	AMDC-UMGIR	○	○
12	Juan José Jiménez	AMDC-Regioplan	○	○
13	Vera S. Véliz	AMDC-Regioplan	○	○
14	Freddy Flores	AMDC-Regioplan	○	○
15	Mario Antonio Aguilera	AMDC-Regioplan	○	○
16	Mario R. Reyes	AMDC-Regioplan		○
17	Rigoberto Moncada	Assistant to JCT	○	○

講習会スタイル : 講師である Rigoberto 氏の PC をプロジェクターに繋げて、Rigoberto 氏が作業を行いながら (作業状況がスクリーンに表示されながら) 説明し、その後に参加者が同じ作業を各自の PC で実施する、という流れを繰り返しながら講習を行った。不明点があるごとに手を挙げて質問し、Rigoberto 氏や IHCIT の GIS 担当者が返答した。また参加者は作業中も周囲と相談しながら進めていた。

## 【8/27】

### <講習内容>

- ・ Google Earth による位置情報の取得
- ・ ArcGIS による画像表示と位置情報合わせ

ArcGIS を使って、写真判読結果および現地調査結果デジタル化する講習会を行った。

はじめに、Google Earth の操作方法から説明し、次にパイロットサイト (El Edén と Nueva Santa Rosa) をそれぞれ表示させ、サイト画像から複数点の位置情報 (緯度・経度) を取得した。次に、ArcGIS を用いてパイロットサイトの空中写真データ上に、取得した複数点の位置情報 (緯度・経度) を設定することにより、「位置情報を持つ空中写真データ」を作成した。その後、表示方法や補正方法などの補足説明が行われた。

### <感想>

参加者の多くは市役所職員などであり GIS をほとんど使用したことがないものもいたことから、上記の作業を 3 時間かけてじっくり説明した。そのおかげで、全員が基礎操作を理解しているようであった。途中の質問を Rigoberto 氏らが丁寧に解答したことによって不明点は解決したようである。

## 【8/28】

### <講習内容>

- ・ ArcGIS によるライン・ポリゴン作図
- ・ ArcGIS への GPS データ・写真データの取込み

昨日の続きで、ArcGIS の基本的な操作 (表示、拡大、縮小など) の説明後に「空中写真データ」上へのライン・ポリゴンの作図方法の指導が行われた。作図後に図形の色づけ・変形・修正などを手順が説明され、各図に対する属性情報の入力方法などについて指導が行われた。

また各人が作成した判読図ならびに現地調査結果図は前日に IHCIT がスキャンし、各人にメール配布されていた。それらスキャンデータを元に、地すべり分布図のデジタル化が行われた。さらに現地調査での GPS データや写真データ (GPS による位置情報があるもの) の取り込みについて説明がなされ、地すべり分布図上での表示方法について指導が行われた。

### <感想>

いずれも基礎作業を、説明→実習を繰り返し行なったことから、参加者は作業の流れを理解した。しかしながら、ArcGIS を使い慣れていない参加者の多くは実際の作図作業等に非常に時間がかかり、時間内に判読図のデジタル化は完了しなかった。今後も継続的な作業トレーニングが必要であると思われる。

(次頁写真)







# 添付資料 3 - 3

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技術移転セミナー開催報告



ホンジュラス国 首都圏における地すべり対策能力強化支援

**第1回技術移転セミナー（活動⑥）の開催報告**

本案件における技術移転セミナーは、短期専門家が主体となって実施する「活動⑥テグシガルパ市地すべり台帳とリスクマップ作成に関する技術移転及びそれら活用に関する助言」の一環で実施するものである。

2015年5月20日（水）に第1回技術移転セミナーを COPECO 会議室において開催した。本セミナーは、地すべり台帳とリスクマップ作成に関する技術移転を行うにあたり、前回の JICA-JSPS 地すべりプロジェクトおよび今回の技術移転内容の概要の理解を促す目的で実施した。

C/P 機関である UNAH（主に IHCIT：地球科学研究所）および AMDC（テグシガルパ市役所）、UPI（ホンジュラス工科大学）、COPECO、INSEP、GOAL（NGO）等に対して招待状を送付し、合計 33 人の参加があった。講師は JICA 短期専門家 4 名、コンサルタントチーム 1 名、元 JICA 職員 1 名、計 6 名で、約 2 時間の講義を実施した。

以下に議事次第・参加者リスト・所感等を述べる。

表-1 技術移転ワークショップの議事次第

1 <sup>st</sup> TECHNICAL TRANSFER SEMINAR			
Date	20th May, 2015, Wednesday, 9:00-11:00		
Venue	Conference room at COPECO		
AGENDA			
1	Opening speech	Nishiki, JICA Honduras	9:00 - 9:05
2	Introduction of the previous JICA-JSPS project	Yamagishi, JICA Expert	9:05 - 9:20
3	Outline of the landslide project	Kuwano, JICA Consultant	9:20 - 9:30
4	Topographical interpretation on landslides	Sato, JICA Expert	9:30 - 9:50
5	Hazard and risk assessment on landslides	Yagi, JICA Expert	9:50 - 10:10
6	How to make and use the landslide map in Tegucigalpa	Rigoberto Moncada Yamagishi, JICA Expert	10:10 - 10:30
7	Landslide disasters in Tegucigalpa city	Hirota, JICA Expert	10:30 - 10:50
8	Closing speech	Marco R. Funes UMGIR, AMDC	10:50 - 11:00

表-2 技術移転ワークショップの参加者リスト

参加者	ポジション	所属
Oscar Elvir Fernandez	Teacher/Reseacher	IHCIT (UNAH)
Lidia Torres	Teacher/Reseacher	IHCIT (UNAH)
Maynor Ruiz	Geologist	IHCIT (UNAH)
José Cordero	Student LAAF	UNAH
Elizabeth Espinoza	Student Geology	UNAH
Marco R. Funes	Project Evaluator	UMGIR (AMDC)
Ferid Gabrie	Industrial Engineer	CODEM (AMDC)
Jose Ramón Anariba	Alerta Temprana	CODEM (AMDC)
Oscar Amilcar Pavon	Informatic	CODEM (AMDC)
Francisco Bustamante	Project Evaluator	GER (AMDC)
Marcio Lopez	Project Evaluator	GER (AMDC)

Karen Cubas	Manager	GER (AMDC)
Vera S. Véliz	Consultant	AMDC
Leevan Narvaez	Student	UPI
Carlos Hernández	Student	UPI
Anibal Godoy	Geologist	IGH-UPI
Hugo D. Medieta	Prevention Official	COPECO
Gustavo Araujo	COPECO	COPECO
Jorge Miguel Aguilar	Prevention Official	COPECO
Yolanda Fletes	Prevention Official	COPECO
Lenin Díaz	Link for JICA	COPECO
Carmi Velasquez	COPECO	COPECO
Edgardo Arita	Financial Analyser	COPECO
Josue Bustillo	Assit. Project Social Direction	COPECO
Ricardo Jimenez	Civil Engineer	COPECO
Ernesto Salgado	Chief of CENAOS	COPECO
Roger Torres	Sub-Commissioner	COPECO
Jose Johel Campos	Project Coordinator	INSEP
Ramon Cruz	Technical analyser	INSEP
Juan Jose Alberto	Architect	INSEP
Danira Andrews	Coordinator	INSEP
Rosa Maria Bonilla	Sub-Chief CHN	INSEP
Jorge Tejeda	GOAL	GOAL
<p>【JICAホンジュラス】 西木</p> <p>【JICA短期専門家】 山岸、廣田、八木、佐藤、Rigoberto Moncada</p> <p>【JICAコンサルタントチーム】 桑野、塚本</p>		

<所感>

- ・ 招待状を送ったすべての機関から参加者がおり、ホンジュラス側の関心の高さが伺える。
- ・ 盛りだくさんの講義に対して、参加者の途中退席などはなく、熱心に聴いていた。
- ・ 講義の最初に前回の JICA-JSPS プロジェクトの概要を説明したことにより、参加者が JICA 地すべりプロジェクトの全体的な流れを把握することができ、有意義であったと思われる。
- ・ 前回の JICA-JSPS プロジェクトにおいて実際の作業を経験した、元 JICA 職員の Rigoberto 氏を講師としたことで、GIS を使った地すべり位置図の作成方法の具体論をわかりやすい説明することができた。
- ・ 参加者からほとんど質問はでなかったが、これはまだ作業内容の具体的なイメージがつかめていないためだと思われ、今後、第 2 回、第 3 回と、活発な議論が実施されると予想する。
- ・ JICA ホンジュラスにおいて同時通訳（英語⇄西語）を備上してくれたおかげで、参加者間のスムーズなコミュニケーションが可能となり、時間も効率的に使うことができた。



写真1 西木副所長によるオープニングスピーチ



写真2 Marco 職員(AMDC)によるクロージングスピーチ



写真3 聴講の様子(短期専門家)



写真4 聴講の様子



写真5 聴講の様子



写真6 山岸専門家の講義



ホンジュラス国 首都圏における地すべり対策能力強化支援

## 第2回技術移転セミナーの開催報告

塚本 哲（JICA コンサルタントチーム：JCT）

日時：2015年9月21日（月）14：00-16：00

開催場所：AMDC の CODEM 会議室

参加者：22名（参加者リストは別紙）

講師：UNAH 担当者、AMDC 担当者、廣田専門家、塚本 JCT ほか（別紙議事参照）

前回は日本人専門家による技術移転であったのに対し、今回の技術移転セミナーは、ホンジュラス側の担当者+日本側（廣田専門家、塚本 JCT）が地すべり調査、対策関係者に技術移転することを目的として実施した。

プロジェクトが開始されてから約5ヶ月が経過し、JCT とのさまざまな活動、さらに専門家の先生方の指導の成果ができつつある。本セミナーでは、UNAH および AMDC の作業方針の説明、地すべり調査の進捗状況、今後の作業方針などが丁寧に説明された。

特に、注目されたのは、日本人専門家の指導の成果を着実に整理している点である。2サイトの写真判読結果は地図上に表現し、ある程度のハザード評価がなされていた。仔細に見ると、表現上の問題はあるが、自主的に作業を進めている点は評価される。

今後は、JCT が引き続き指導するが、ワーキンググループの自主的活動を側方支援してることが望ましい。地すべり範囲・形状の確認、GIS の活用、Susceptibility 評価、地すべり台帳の作成は、2016年2月に日本人専門家+JCT が改めて指導することが望ましい。

なお、数名の参加者より、口頭および E-Mail で本技術移転セミナーがとても有益であったとのコメントが寄せられた。

発表内容の概要

タイトル	発表者	概要
1. Palabra de Apertura 開会の辞	Juan Carlos García Vice-Alcalde-AMDC	副市長として JICA による、AMDC 及び UNAH の地すべり対策能力強化に感謝する。このプロジェクトにより職員が知識を得ることができる。気候変動の影響は本市にも及んでいるため、地すべり・洪水災害を軽減する寄与するこのプロジェクトの進展に満足している。
2. Método de Inventario de Deslizamiento. 地すべり台帳の作成方法	Oscar Elvir IHCIT	これまで学習したこと：地すべりの基礎知識、サセプタビリティマップ作成方法の学習・理解、作業分担（ゴドイ：プレートテクトニクス、ルイス：地質学、ロドリゲス：地物、カルドナ：GIS）、写真判読方法・練習、現地確認、リスクと脆弱性の認識に関する住民アンケートの実施、調査地域の地質
3. Aplicación de la Transferencia Tecnológica. 技術移転の応用	Marco R. Fúnes UMGIR-AMDC	地すべり災害の抑制、軽減のための能力強化・担当者の能力形成、コンサルタントのためのセミナー、パイロットサイトでの地すべり発見の技術、WG の結成と活動、写真判読技術の取得、現地調査技術、マップ化、住民インタビュー、ベリンチェとレパルトの地すべりモニタリングの継続、JCT による最近の地すべり現場の調査（8/3,8/31）、原因と問題点の提示
4. Mapa de Amenaza y Deslizamiento. 地すべりハザードマップ	Satoru. Tsukamoto Grupo Consultor JICA	日本の地すべり災害、防災科研の地すべり分布図プロジェクト、地すべりハザードマップの事例、地すべりハザードマップの活用（構造物対策、早期警戒・避難、土地利用計画・建築規制）
5. Método de Investigación en el Sitio de Deslizamiento. 地すべり現地調査方法	Aníbal Godoy IGH- UPI	調査の流れ、写真判読法の学習、現地調査、現地地質調査結果の図化、地すべりと地質の重ね合わせ、
6. Digitalización y uso del SIG en el Mapa de Amenaza y Deslizamiento. ハザードマップと地すべり分野でのデジタル化と GIS	Alex Cardona Experto de IHCIT	GIS による地すべり“リスク”マップの作成状況、WG の活動状況、DEM の作成、サイト調査、写真判読、判読結果のデジタル化、サイトでの再確認
7. Plan de Actividades de Transferencia Tecnológica en el Proyecto. 本プロジェクトでの技術移転活動計画	Kiyoharu Hirota Experto de JICA	調査活動内容、地すべり台帳の作成方法、地すべり番号のつけ方、記載内容、UNAH と AMDC の協力関係、詳細な地質調査の計画、今月の活動と今後の技術移転活動計画
8. Palabras de Cierre 閉会の辞	Gloriana Alfaro Oficina JICA Honduras	JCT による技術移転と能力強化は JICA のゴールの一つである。プロジェクト実施の中で C/P の関与が重要になってくる。JCT との協調が期待される。本セミナーは技術移転の良い機会となった。



参加者リスト

No.	NAMES	ORGANIZATION
1	Lidia Torres B.	IHCIT-UNAH
2	Oscar Elvir Ferman	IHCIT-UNAH
3	Alex Cardona	IHCIT-UNAH
4	Nelson Sevilla Raudales	IHCIT-UNAH
5	Maynor Ruiz	IHCIT-UNAH
6	Erick Salgado	UNAH (Teacher)
7	Marck Reilly Mullings	UNAH (Student I.F.)
8	Elisabeth Espinoza	UNAH(Teacher)
9	Marco Rolando Fúnes	UMGIR-AMDC
10	Karen Cubas	GER-AMDC
11	Eneyda Rodríguez	GER-AMDC
12	José Pinto	GER-AMDC
13	Vera Veliz	Infraestruct. AMDC.
14	Jorge Aguilar	COPECO
15	Aníbal Godoy	UPI IGH
16	Ana Natarén	UPI
17	Carlos Hernández	UPI
18	Javier García	UPNFM
19	Mario Aguilera	Regioplan
20	Fredy Flores	Regioplan
21	Jorge Tejeda	GOAL
22	José Anariba	CODEM
23	Ferid Gabrie	CODEM
24	Oscar Pavón	CODEM
25	Roger Cañas	CODEM
26	Gloriana Alfaro	JICA
27	Juan Carlos García	Sub Major /Vicealcalde
28	Kiyoharu Hirota	JICA Expert
29	Satoru Tsukamoto	JCT
30	Victoria Argueta de Saavedra	JCT Office Assistant



Juan Carlos García  
Vice-Alcalde-AMDC



Oscar Elvir IHCIT,UNAH



Marco R. Fúnes  
UMGIR-AMDC



Satoru. Tsukamoto, JCT



Aníbal Godoy, IGH- UPI



Alex Cardona  
Experto de IHCIT



Kiyoharu Hirota  
Experto de JICA



Gloriana Alfaro  
Oficina JICA Honduras





ホンジュラス国 首都圏における地すべり対策能力強化支援

**第3回技術移転セミナーの開催報告**

桑野 健（JICA コンサルタントチーム：JCT）

2/10～2/26に短期専門家が現地入りし、期間中に技術トレーニング、現地調査、JCC等を実施した。第1週目（2/10-12）および第3週目（2/22-26）は任意参加とし、第2週（2/15-19）の活動には原則的に全C/Pが参加することとした。また第2週の最終日（2/19）にはC/P代表（4グループの各代表者）が、今回の技術トレーニングで学んだ内容について発表を行った。なお、本期間における一連の技術トレーニングを「第3回技術移転セミナー」とする。

以下に技術トレーニングの内容一覧を示す。

表：短期専門家による技術トレーニング・現地調査の内容

2/10（水） 8:30-12:00	Nueva Santa Rosa	廣田	【現地】地形調査・地質調査・変状確認
2/11（木） 8:30-12:00	Nueva Santa Rosa	廣田	【現地】地形調査・地質調査・変状確認
2/12（金） 8:30-12:00	Nueva Santa Rosa	廣田、佐藤	【現地】地形調査・地質調査・変状確認
2/15（月） 13:30-14:30	IHCIT 教室[UNAH]	八木	【講義】地すべり地形の分類
2/15（月） 14:30-16:00	IHCIT 教室[UNAH]	佐藤	【講義】地形判読講義（日本の地すべりの例） 【実習】地形判読
2/16（火） 9:00-12:00	IHCIT 教室[UNAH]	佐藤、八木、 廣田、	【実習】地すべり分布図の作成 【実習】地すべり断面図の作成
2/16（火） 13:30-16:00	IHCIT 教室[UNAH]	佐藤、八木、 廣田、	【実習】地すべり断面図の作成 【実習】災害関連情報の整理、台帳作成
2/17（水） 8:30-12:00	Nueva Santa Rosa El Eden	廣田、八木 佐藤	【現地】地形調査・地質調査・変状確認
2/17（水） 13:30-16:00	IHCIT 教室[UNAH]	八木、佐藤、 廣田	【講義】地すべりの危険度評価 【実習】地すべりの危険度評価
2/18（木） 13:30-16:00	IHCIT 教室[UNAH]	八木、佐藤、 廣田	【実習】地すべりの危険度評価 【実習】災害関連情報の整理、台帳作成 ・翌日のプレゼンテーション準備
2/19（金） 9:30-12:00	IHCIT 教室[UNAH]	廣田、八木、 佐藤	・C/Pによるプレゼンテーション
2/22（月） 8:30-12:00	Nueva Santa Rosa	廣田	【現地】地すべり台帳作成のための現地調査
2/22（月） 13:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】関連情報の整理、地すべり台帳作成
2/23（火） 8:30-12:00	Nueva Santa Rosa	廣田	【現地】地すべり台帳作成のための現地調査
2/23（火） 13:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべり台帳作成
2/24（水） 8:30-12:00	El Eden	廣田	【現地】地すべり台帳作成のための現地調査
2/24（水）	IHCIT 教室[UNAH]	廣田	【実習】関連情報の整理、地すべり台帳作成

13:30-16:00			
2/25 (木) 8:30-12:00	El Eden	廣田	【現地】地すべり台帳作成のための現地調査
2/25 (木) 13:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべり台帳作成
2/26 (金) 8:30-12:00	IHCIT 教室[UNAH]	廣田	【実習】地すべり台帳作成

今回の技術トレーニングではパイロットサイトの Nueva Santa Rosa と El Eden に対して

- 1) 地形判読による地すべり分布図の作成
- 2) 代表断面における地すべり断面図の作成
- 3) 分布図中の各地すべりに対する危険度評価
- 4) 分布図中の各地すべりに対する台帳の作成

の一連の講義、実習、現地調査を実施した。実習は、日本人の短期専門家やコンサルタントが支援するかたちで各グループ（4～8名程度）に作業させることで、必ず参加者全員が自ら手を動かす状態とした。これにより、より深い理解が得られていたようで、第2週の後半以降はグループ内で議論をしながら、自分たちで危険度評価や地すべり台帳記載を実施できる状態までに至った。

今後、3月中に各地すべりの危険度評価と台帳作成を C/P 自身が行い、3月下旬から渡航するコンサルタントと最終化する予定である。次回の専門家派遣時（4月末～5月はじめ）に、完成した地すべり台帳および地すべり分布図を GIS 上で表現し、GIS 地すべりマップ作成の技術移転を行う。その後5～6月にかけて C/P が GIS 地すべりリスクマップ（サスセプタビリティマップ）を完成させる。これらの成果を7月に実施する第2回中米地すべり会議で発表する予定である。

## Participant List

**Purpose: Site Investigation/Data Compilation/Seminars**

Venue: Nueva Santa Rosa & UNAH

Hour: 8:30 am to 11:30 am Afternoon : 1:30-4:00 pm

No.	Name	Organization	Assistance to Pilot Site Nueva Sta. Rosa	Assistance to Pilot Site Nueva Sta. Roca	Assistance to Pilot Site Nueva Sta. Rosa	Assistance Seminar	Assistance Seminar	*Assistance to Pilot Sites	**Assistance Seminar	Preparation for their presentation	Presentation by C/P	Pilot Site Nueva Sta. Rosa/Data Compilation	Pilot Site Nueva Sta. Rosa /Data Completion	Pilot Site El Eden /Data Completion	Pilot Site El Eden /Data Completion	Training In Landslide Inventory
			2016/2/10	2016/2/11	2016/2/12	2016/2/15	2016/2/16	2016/2/17		2016/2/18	2016/2/19	2016/2/22	2016/2/23	2016/2/24	2016/2/25	2016/2/26
1	Mark Reilly Mullings	UNAH/IHCIT	●	●	●	●	●	●	●	●	●	●	●	●	●	●
2	Nelson Sevilla	UNAH/IHCIT				●	●		●		●					
3	Oscar Elvir	UNAH/IHCIT				●	●	●	●	●					●	●
4	Maynor Ruiz Alvarez	UNAH/IHCIT				●										
5	Erick Francisco Salgado	UNAH/IHCIT				●	●	●	●		●					
6	Lidia Torres	UNAH/IHCIT					●	●	●							●
7	Elisabeth Espinoza	UNAH/UPNFM				●	●		●	●	●			●	●	
8	Elias García Urquia	UNAH/Civil Engineering	●	●	●	●	●	●	●	●	●	●		●		●
9	Ana Natarén	UPI	●	●		●	●	●	●	●	●	●	●			●
10	Javier Garcia Reynaud	UPNFM		●		●	●		●		●			●	●	
11	Marco R. Funes	AMDC/UMGIR	●	●	●	●	●	●		●	●			●	●	●
12	Ruben Hernandez	AMDC/UMGIR					●	●	●							
13	Ferid Gabrie	AMDC/CODEM				●	●	●	●	●	●			●	●	
14	Roger Cañas Dubón	AMDC/CODEM				●	●	●	●	●	●			●		
15	Jose Ramon Anariba	AMDC/CODEM					●	●	●	●	●			●		
16	Oscar Amilcar Pavon	AMDC/CODEM					●	●	●	●				●	●	
17	Blanca Laínez	AMDC/CODEM	●													
18	Giuliano Ramirez B	AMDC/CODEM	●		●											
19	José Merlin Aguilera	AMDC/CODEM	●													
20	Marcio Lopez Estrada	AMDC/GER		●		●	●	●	●	●	●					●
21	Francisco Bustamante	AMDC/GER				●	●	●	●							
22	José Alberto Pinto	AMDC/GER	●		●	●	●	●	●	●	●	●	●	●		●
23	Ricardo Jimenez	COPECO					●									
24	Rudi Javier Argeñal	COPECO/CENID				●	●	●	●	●						
25	Jorge Miguel Aguilar Medina	COPECO/DGP				●	●	●	●	●				●	●	
26	Vera S. Véliz	AMDC/ Consulting				●	●		●		●					
27	Fredy David Flores	AMDC/ Consulting				●	●	●	●		●			●	●	
28	Juan Jose Jimenez	AMDC/ Consulting					●	●	●					●	●	
29	Mario Aguilera	AMDC/ Consulting					●	●	●	●	●			●	●	●
30	Jorge A. Tejada	GOAL				●	●							●		

\* the regular participants excused for the site visit because work issues but they attended afternoon.

\*\* Only Ing. Marco Funes excused not to attend the seminar afternoon.

【2月15日（月）13：30-16：00 講義・演習】



八木先生による地すべり分類の講義



八木先生による地すべり分類の説明



佐藤先生による日本の地すべり地形分布図の紹介



立体地形解析図にかかるとの演習

【2月16日（火）9：00-12：00 講義・演習】



佐藤先生による空中写真判読の説明



空中写真判読の演習



地すべりの抽出作業



八木先生による地すべり分布図作成の指導



【2月16日（火）13：30-16：00 講義・演習】



グループごとによる地すべり分布図作成



廣田先生による地すべり断面図作成の指導



地すべり断面図作成作業



各地すべりブロックの情報抽出・整理

【2月17日（水）8：00-12：00 現地調査（Nueva Santa Rosa）】



調査地を地図上で確認



現地状況の確認



インベントリーの説明



地すべりブロックを地図上で確認

【2月17日（水）8：00-12：00 現地調査（El Eden）】



調査地を地図上で確認



地すべり地における植生等の状況確認



グループごとによる現地状況の考察



現地調査参加者の集合写真

【2月17日（水）13：30-16：00 演習】



グループごとによる現場調査の結果の話し合い



八木先生による危険度評価のグループ指導



廣田先生による危険度評価のグループ指導



危険度評価の演習

【2月18日（木）13:30-16:00 プレゼン準備】



グループごとによるプレゼン準備



佐藤先生によるプレゼン内容の確認・指導



プレゼン内容検討



八木先生によるプレゼン内容の確認・指導

【2月19日（金）午前9:30-12:00 プレゼン発表】



グループ発表（Nueva Santa Rosa グループ）



グループ発表（El Eden グループ）



八木先生による危険度評価にかかる留意事項説明



研修参加者の集合写真



ホンジュラス国 首都圏における地すべり対策能力強化支援

**第4回技術移転セミナーの開催報告**

塚本 哲（JICA コンサルタントチーム：JCT）

4/13～5/6 に短期専門家が現地入りし、期間中に技術トレーニング、現地調査等を実施した。廣田専門家は 4/14～5/5、八木専門家は 5/3～5 にそれぞれ技術移転活動を行った。本期間における一連の技術トレーニングを「第5回技術移転セミナー」とする。

以下に技術トレーニングの内容一覧を示す。

表：短期専門家による技術トレーニング・現地調査の内容

日時	開催場所	専門家	活動内容
4/14（木） 8:30-12:00	El Eden	廣田	【現地】地すべりブロックの確認、GPSによるデータ作成
4/15（金） 8:30-12:00	Nueva Santa Rosa	廣田	【現地】地すべり変状個所の確認、GPSによるデータ作成
4/18（月） 8:30-12:00 13:30-16:00	Nueva Santa Rosa IHCIT 教室[UNAH]	廣田	【現地】同上（継続） 【実習】地すべりインベントリー作成（Nueva Santa Rosa グループ）
4/19（火） 8:30-12:00	El Eden	廣田	【現地】地すべりブロックの確認、GPSによるデータ作成
4/21（木） 8:30-12:00 13:30-16:00	El Eden IHCIT 教室[UNAH]	廣田	【現地】同上（継続） 【実習】地すべり分布図の作成（El Eden グループ）
4/22（金） 8:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべり分布図の作成（El Eden グループ）
4/25（月） 8:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべりインベントリー作成（Nueva Santa Rosa グループ）
4/26（火） 13:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべり分布図の作成（El Eden グループ）
4/27（水） 8:30-12:00	IHCIT 教室[UNAH]	廣田	【実習】地すべりインベントリー作成（Nueva Santa Rosa グループ）
4/27（水） 13:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべりサセプタビリティ評価（El Eden グループ）
4/29（木） 9:30-16:00	IHCIT 教室[UNAH]	廣田	【実習】地すべりインベントリー作成（El Eden グループ）
5/3（火） 9:30-12:00	IHCIT 教室[UNAH]	廣田、 八木	【実習】地すべりサセプタビリティ評価（Nueva Santa Rosa グループ）
5/4（水） 9:30-12:00	IHCIT 教室[UNAH]	廣田、 八木	【実習】同上（継続）
5/5（木） 13:30-16:00	IHCIT 教室[UNAH]	廣田、 八木	【実習】地すべりサセプタビリティ評価（El Eden グループ）

今回の技術トレーニングではパイロットサイトの Nueva Santa Rosa と El Eden に対して

- 1) 地すべり分布図の作成（特に、地すべり境界の決定）
- 2) 地すべりサセプタビリティ評価
- 3) 地すべりインベントリーの記載内容の検討
- 4) サセプタビリティ、ハザード、リスク評価の違いの確認
- 5) 地すべりデータの GIS 管理手法

をテーマとして一連の現地調査、実習を行った。

これらの活動期間、日本人の短期専門家やコンサルタントが支援するかたちで各グループ（4～8 名程度）に作業させることで、必ず参加者全員が自ら手を動かす状態とした。すでに、GIS 技術は取得しており、マーク氏が両グループのデータを取りまとめ、統一的なフォーム、考え方で地すべりサセプタビリティ評価、地すべりインベントリーを作成したことが、成果の統一、円滑な作業に貢献した。5 月初旬の段階で、自分たちでサセプタビリティ評価や地すべりインベントリー記載ができるレベルに至った。

今後、本邦招聘期間に JICA 本部、短期専門家を交えて、成果のプレゼンテーションする機会を作り、さらにレベルアップすることが望まれる。最終成果は 2016 年 7 月に予定されている中米・カリブ地域地すべり会議に展示できるレベルまで、高める必要がある。

## Participant List

**Purpose:** Site Investigation/Data Compilation

**Venue:** Site Visits & Data process in UNAH

**Hour:** 8:30 am to 11:30 am Afternoon : 1:30-4:00 pm

Team	No.	Name	Organization	Field visit	Field visit	Data Process	Data Process	Data Process	Data Process
				4/15	4/18	4/25	4/27	5/3	5/4
ROSAURAUENA	1	Ana Milagro Natarén Alvarez	UPI	•		•	•		•
	2	Mark Reilly Mullings Najera	UNAH-IHCIT	•	•	•	•	•	•
	3	Nelson Sevilla	UNAH-IHCIT	•				•	
	4	Elias Garcia Urquia	UNAH-DIC		•	•	•	•	•
	5	Jose Alberto Pinto	AMDC-GER	•	•	•	•	•	•
	6	Marcio Lopez Estrada	AMDC-GER	•	•		•	•	•
	7	Karen Cubas	AMDC-GER	•	•				
	8	Eneyda Rodriguez	AMDC-GER	•					
	9	Francisco Bustamante	AMDC-GER	•					
	10	Angela Gabriela Morales	UNAH-DIC		•				
	11	Diana Mabel Muñoz	UNAH-DIC		•				
				8	7	4	5	5	5

Team	No.	Name	Organization	Field visit	Field visit	Field visit/ Data Process	Data Process	Data Process	Data Process	Data Process	Data Process
				4/14	4/19	4/21	4/22	4/26	4/27	4/29	5/5
EL EDEN	1	Vera S. Véliz	AMDC/ Consulting	•	•	•			•	•	•
	2	Fredy David Flores	AMDC/ Consulting	•	•	•			•	•	•
	3	Juan Jose Jimenez	AMDC/ Consulting	•	•	•			•	•	•
	4	Mario Aguilera	AMDC/ Consulting		•	•	•	•	•		
	5	Marco R. Funes	AMDC/UMGIR		•	•	•	•	•	•	
	6	Oscar Rolando Elvir	UNAH/IHCIT	•						•	
	7	Lidia Elizabeth Torres	UNAH/IHCIT	•						•	
	8	Elisabeth Espinoza	UNAH/UPNFM	•	•	•	•	•	•	•	•
	9	Javier Garcia Reynaud	UPNFM	•	•	•	•	•	•	•	•
	10	Jorge A. Tejeda	GOAL	•							
	11	Ferid Antonio Gabrie	AMDC/CODEM	•							
	12	Roger Cañas Dubón	AMDC/CODEM			•	•				
	13	Oscar Amilcar Pavon	AMDC/CODEM	•							
				10	7	8	5	4	7	8	5
				1	2	2	2	1	1	1	1
				11	9	10	7	5	8	9	6

\* MARK has been assisting with GIS to Eden in April 14, 19, 21, 22, 26, 29 and 5th May

\* Alex Javier Cardona from IHCIT supported with GIS April 19, 21, 22, for NSR 27

【4月14日(木)8:30-12:00 現地調査(El Eden)】



TWGの現場協議



TWGの現場協議

【4月15日(金)8:30-12:00 現地調査(Nueva Santa Rosa)】



廣田先生による現場指導



【4月18日(月)8:30-12:00 現地調査(Nueva Santa Rosa)/13:30-16:00 実習(Nueva Santa Rosa)】



地質露頭観察



廣田先生による現場指導



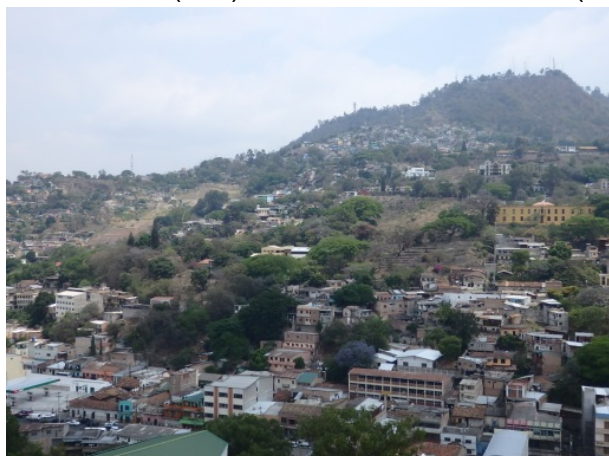


廣田先生による地すべり範囲の線引き指導



TWG による室内協議

【4月19日(火) 8:30-12:00 現地調査 (El Eden)】



ホテル屋上から見た El Eden 地すべり



廣田先生による現場指導

【4月21日(木) 8:30-12:00 現地調査 (El Eden) /13:30-16:00 実習 (El Eden グループ)】



TWG による室内協議



【4月22日(金) 8:30-16:00 実習 ( El Eden グループ )】



塚本団員による評価手法の説明



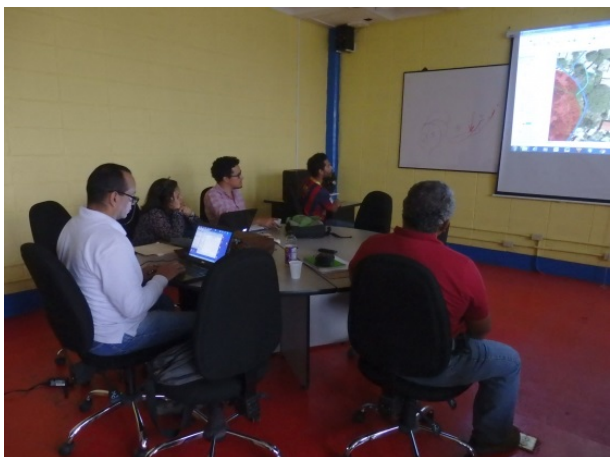
手作業による地すべり分布図

【4月25日(月) 8:30-16:00 実習 ( Nueva Santa Rosa グループ )】

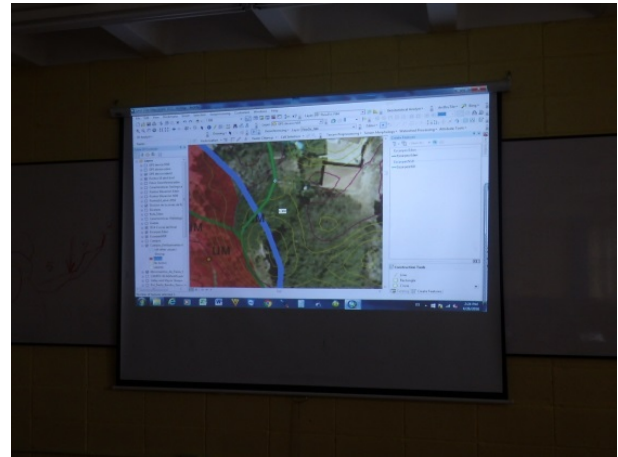


TWGによる地すべりデータ作成作業

【4月26日(火) 13:30-16:00 実習 ( El Eden グループ )】



TWGによる地すべりデータ作成作業



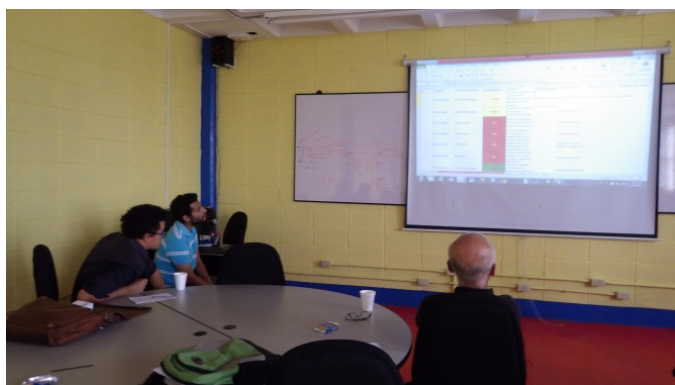
GISによる地すべりマップ

【4月27日(水) 8:30-12:00 実習 ( Nueva Santa Rosa グループ )】



TWGによる地すべりデータ作成作業

【4月29日(金) 9:30-16:00 実習 ( El Eden グループ )】



TWGによる地すべりデータ作成作業

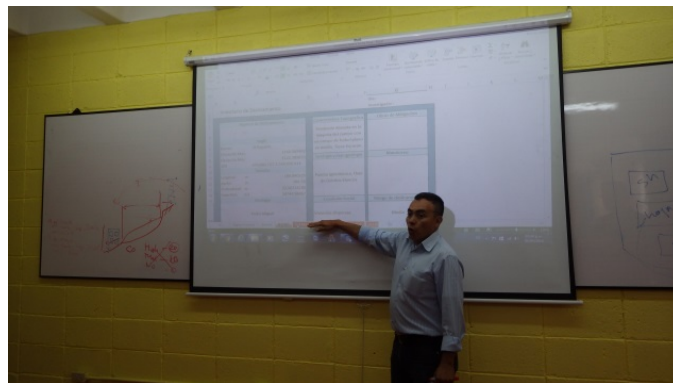
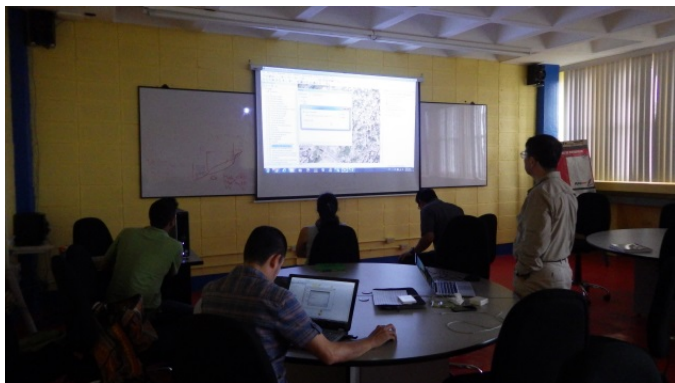
地すべり分布図と地質図の重ね合わせ

【5月3日(火) 9:30-12:00 実習 ( Nueva Santa Rosa グループ )】



八木専門家による地すべりサセプタビリティ評価の説明

【5月4日(水)9:30-12:00 実習( Nueva Santa Rosa グループ )】



TWGによる地すべりインベントリーに係る協議

【5月5日(木)13:30-16:00 実習( El Eden グループ )】



TWGによる地すべりインベントリーに係る協議



GIS担当のマーク氏

# 添付資料 3 - 4

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第2回中米カリブ地すべり学会  
プログラム





## II Central American and Caribbean Landslide Congress Agenda

Day	Block name	Starting time	Finishing time	Name of presentation/activity	Speaker	Country
Monday July 18		08:00	08:20	Registration of participants		
		08:20	09:00	Opening Ceremony Mr. Yuichi Miyagawa Japan Embassy Counsellor Mrs. Julieta Castellanos, Rector of the Universidad Nacional Autonoma de Honduras, UNAH Mr. Naoki Kamijo, Chief Representative of JICA Honduras Office Mr. Mónico Oyuela, Dean Faculty of Engineering, UNAH Mr. Nabil Kawas, Dean Faculty of Science, UNAH		
	Landslide susceptibility I	09:00	09:25	Landslide susceptibility mapping in data scarce regions using tools from geomorphometry, statistics and data mining - a case study from Maily-Say, Kyrgyzstan	Anika Braun	Germany
		09:25	09:50	Cartography for the landslide process using a geomorphologic method in the upper basin of the General River in Costa Rica	Adolfo Quesada	Costa Rica
		09:50	10:15	Morphometric model for the landslide susceptibility determination: a case study for the northeastern slope of the Poas Volcano	Gustavo Barrantes	Costa Rica
		10:15	10:45	Coffee Break		
	Landslide susceptibility II	10:45	11:10	Evaluation of the debris flows and landslides in El Pilan community, El Ayote, South Caribbean Autonomous region, Nicaragua	Gisselle Bellorín	Nicaragua
		11:10	11:35	Landslide susceptibility analysis in the Jamapa and La Antigua watersheds	Gilbert Torres	Mexico
		11:35	12:00	Update of the map for critical sites and landslide monitoring in Nicaragua	Eveling Espinoza	Nicaragua
		12:00	13:15	Lunch		
	Hazard and risk assesment I	13:15	13:40	Landslide characterization in Nicaragua	William Martínez	Nicaragua
		13:40	14:05	Development of a landslide risk rating system for small-scale landslides affecting settlements in Guatemala City	Ethan Faber	Guatemala
		14:05	14:30	Technical and prospective evaluation of landslide risk in Granma province, Cuba	Eberto Hernandez	Cuba
		14:30	14:55	Threat assessment in Juco basin, Orosi, Paraiso, Cartago, Costa Rica	Luis Guillermo Salazar	Costa Rica
		14:55	15:25	Coffee Break		
	Hazard and risk assesment II	15:25	15:50	Application of the Cuban Methodology for Hazard, Vulnerability and Risk studies for landslides at municipality level in Villa Clara Province. Republic of Cuba.	Francisco Viera	Cuba
		15:50	16:15	Landslide risk assessment in the commune of Petit Goáve Republic of Haiti	Eberto Hernandez	Cuba
		16:15	16:40	Scale and objectives, landslide susceptibility mapping adopting Analytical Hierarchical Process (AHP) method.	Hiroshi Yagi	Japan
		16:40	17:00	Closure of session		



Day		Starting time	Finishing time	Name of presentation/activity	Speaker	Country
Tuesday July 19	Landslides studies at local level, Tegucigalpa	08:00	08:25	JICA Landslide Project for Strengthening and Capacity Building of the Control and Mitigation in Honduras	Takeshi Kuwano	Japon
		08:25	08:50	Landslides Susceptibility Analysis in Urban Environments: A Case Study in the Area of El Eden, Central District, Honduras.	Javier Garcia	Honduras
		08:50	09:15	Preliminary Report: Relationship between geology and landform in landslides of the Tegucigalpa Basin, Honduras	Kiyoharu Hirota	Japon
		09:15	09:40	Landslide mapping using a 2m DEM based on AW3D digital topographic data in Tegucigalpa, Honduras	Go Sato	Japon
		09:40	10:10	Coffee Break		
	Landslides studies at local level, Tegucigalpa	10:10	10:35	How to make a database for landslides in Tegucigalpa as a learning interactive teaching tool	Lidia Torres Bernhard	Honduras
		10:35	11:00	Landslide susceptibility characterization in the Ulloa neighborhood in Tegucigalpa, Honduras	Jorge Tejada	Honduras
		11:00	11:25	Systemic approach for urban disaster risk reduction	Ana Nuñez	Honduras
		11:25	11:50	Monitoring system in major landslide sites in Tegucigalpa, Honduras	Julio Anariba	Honduras
		11:50	13:05	Lunch		
	Landslides studies at local level, Tegucigalpa	13:05	13:30	Geophysical Prospection and Layering Analysis of a Landslide susceptible area	Luis Vargas	Honduras
		13:30	13:55	The Project for Landslide Prevention in Berrinche and Reparto in Tegucigalpa	Alejandra Muñoz	Honduras
	Landslides studies at city level, Tegucigalpa	13:55	14:20	Municipal platform for risk, territorial studies and climate change adaption	Rubén Hernández	Honduras
		14:20	14:45	What do we know of landslide hazard in Tegucigalpa?	Gines Suarez	El Salvador
		14:45	15:15	Coffee Break		
	Landslides studies at city level, Tegucigalpa	15:15	15:40	The use of the matrix method for the landslide susceptibility mapping of Tegucigalpa, Honduras	Elias Garcia-Urquia	Honduras
		15:40	16:05	Municipal perspective against landslides in the metropolitan area of Tegucigalpa	Cinthia Borjas	Honduras
		16:05	16:30	Landslide susceptibility map in Nueva Santa Rosa, Tegucigalpa	Nelson Sevilla	Honduras
	Landslides studies outside Tegucigalpa	16:30	16:55	Identification of unstable slopes indicators in Carrizal-Semane, Yamaranguila in the southwest of Honduras (Poster-n-Article)	Ángela Morales	Honduras
		16:55	17:15	Closure of session		





Day		Starting time	Finishing time	Name of presentation/activity	Speaker	Country
Wednesday July 20	Landslides studies outside Tegucigalpa	08:00	08:25	Landslides in Honduras: an overview from the action perspective of COPECO	Jorge Miguel Aguilar	Honduras
		08:25	08:50	Combined Factor Method for the landslide susceptibility analysis	Oscar Elvir	Honduras
	Landslides studies at national level	08:50	09:15	Implementation and future of the LIDAR technology in the landslide identification in Honduras	José Arce	Honduras
		09:15	09:40	JICA Preparatory Survey for The Project for Landslide Prevention in National Road CA-6	Irma Rosario Valladares	Honduras
		09:40	10:10	Coffee Break		
	Landslides and climate change	10:10	10:35	The role of climate change in the Los Andes Centrales slope instabilities	Stella Moreiras	Argentina
		10:35	11:00	Climate change and soils	Aleyda Montoya	El Salvador
	Landslides and seismic activity	11:00	11:25	Landslides prompted by the seismic activity in El Sauce, 2015	Iveth Dávila	Nicaragua
		11:25	11:50	Classification of the coseismic landslide processes of the Chinchona Earthquake in Costa Rica on the 8th of January 2009	Adolfo Quesada	Costa Rica
		11:50	13:05	Lunch		
	Social construction of landslide risk	13:05	13:30	Risk as Social Construct: A Comparative View from Risk Scenarios	Rosa Sánchez	Guatemala
		13:30	13:55	Educational Methodologies Implemented in Latin America for Landslide Inventory and Analysis	Rigoberto Moncada	Honduras
		13:55	14:20	The social construction of risk and landslides in Tuxla Gutiérrez, Chiapas, México	Jorge Paz Tenorio	Mexico
		14:20	14:50	Coffee Break		
	Landslide modelling and field tests	14:50	15:15	Identification and studies of unstable zones in Panama highways and roads	Eric Chichaco	Panama
		15:15	15:40	Modeling shallow landslides triggered by rainfall in the Colombian tropical and mountainous terrains	Edier Aristizabal	Colombia
		15:40	16:05	Electric Tomography in Landslides and Infrastructure monitoring: Experiences from El Salvador	Alonso Alfaro	El Salvador
		16:05	16:30	Closure of session		
		16:30	17:00	Closing ceremony Mr. Nabil Kawas, Dean Faculty of Science, UNAH Mr. Mónico Oyuela, Dean Faculty of Engineering, UNAH Mr. Hiroshi Yagi, JICA		



# 添付資料 3 - 5

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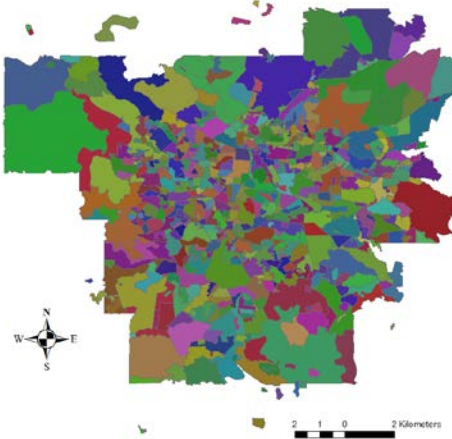
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次期案件要望書

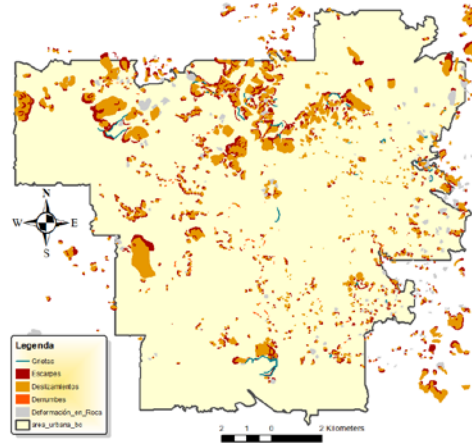




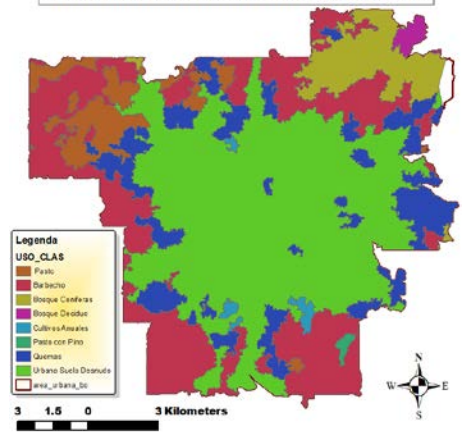
COLONIAS DEL DISTRITO CENTRAL



INVENTARIO DESLIZAM./AREA METROPOLITANA (JICA-2013)



USO DEL SUELO DEL PERIMETRO URBANO DEL DC (INTEMA)



**Project:**

**"Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e"**

<b>1.- Date:</b>	Friday August 05th, 2016
<b>2.- Applicant:</b>	Alcaldía Municipal del Distrito Central
<b>3.- Title of the Project:</b>	Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2E
<b>4.- Type of Project:</b>	Technical Cooperation Project/ Technical Cooperation for the Development Planning.
<b>5.- Contact:</b>	Central District Municipal Office (initials in Spanish AMDC), Mayor's Office. Address: Municipal Campus in the 21st of October Colony, Rincon Neighborhood. Contact Person: Ing. Cinthia Borjas, Mayor's Office Telephone: +504-2221-6971 Celular: +504-9493-0185 Email: <a href="mailto:4094@cichorg.org">4094@cichorg.org</a>

## **6.- BACKGROUND OF THE TECHNICAL COOPERATION**

According to the Climate Risk Global Index for 2015<sup>1</sup>, Honduras maintains the first place on the chart of the ten most affected countries from 1994 to 2013 (Annual average), with a 10.33 score on the Long Term Climate Risk Ranking (CRI). According to this report, in Honduras during this period 69 events were registered that have caused economical loss in around 813.56 millions of American dollars, and a human lives loss rate by the order of 4.6 deaths per 100,000 habitants.

The Index is focused on the impacts generated by the extreme climate phenomenon's like hurricanes, tropical storms, tropical depressions, intense rain, etc., same phenomenon that in our country regularly trigger trough their way emergencies and disasters because of landslide movements and floods.

Particularly, being this one of urban centers most populated<sup>2</sup> of the country, were the majority of economical and commercial activity is concentrated, and were the political- administrative capital is comprise by the cities of Tegucigalpa and Comayagüela, the Central District Municipality represents one of the geographical areas of the national territory were the impacts caused by events of natural origin (mainly extreme climate events), bringing the majority of loss and damages. Added to this, and because of the specific conditions of the geological vulnerability, irregular and steep topography, the deforestation and the residential zone expansion in areas not suitable for housing purposes, the risks caused by landslide movements are exacerbated even more, and thus according with the municipal figures, with at least 350 thousands persons exposed for living on them.

### **DEVELOPMENT POLITICS**

Managing the disaster risks in the Central District Municipality (Tegucigalpa y Comayagüela) and with it reduce the human lives loss and its economic impact, has become an important and urgent necessity to attend from the national perspective, therefore above the base of the National Development Strategy (Republic of Honduras, Country Vision 2010-2038, and the Nation Plan 2010-2022), specifically on the governmental initiative based on the seven sectors of most importance for the environment and climate change, the actions proposed are focused in the prevention. The disasters caused by events of natural origin form part of the seven sectors, being this one of the reasons why the country undertakes

<sup>1</sup> Germanwatch

<sup>2</sup> The estimated population for the Central District for the year 2016, according to the Statistics National Institute (initials in Spanish INE) is of at least 1,276,620 habitants.



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

a race to reducing the risks of disasters through the creation of the SINAGER law, the state policy Integral Risk Management of Honduras (PEGIRH initials in Spanish), and now the construction of its National Plan for Risk Management of Honduras (PNGIRH).

### **PROBLEMS TO SOLVE**

The Central District municipality, because of its particularly natural conditions its geographical location and the combination of different elements of natural-social and anthropogenic origin, has made it the most vulnerable city of the country, estimating that at least 11% of the population is settled in high risk land in the light of landslide movements and floods. In these sense, the estimated annual loss for Central District as a consequence of disasters and damages originated by the effects of natural events are equivalent to \$105 millions of American Dollars a year<sup>3</sup>.

Although of the particular geographical condition, its location and, its physiographical characteristics represent aspects that contribute to generate susceptibility in the light of landslides and floods, the construction of vulnerabilities, as a consequence of the social process, intensifies the problematic.

Inside this process, we can enunciate the increase of the population, the migration from the countryside to the city, the establishment of urbanizations in high risk zone and the invasion of forest areas, etc. Added to this, the lack of the right planning of land use and the absence of historic vigilance by the responsible entities, contribute everyday more to bring about these vulnerabilities, and in general, form the social construction for risk to disasters as a part of the adopted development model.

The demand of housing projects in the capital city, caused by the increase of the population, has brought as a consequence, a strong increase in urban property investments and housing development. These investments, in turn bring a great incidence on the expansion process of populated areas of Central District, and for which this process has been obliged to identify spaces in the territory that meet the right conditions for the implementation of the developments. However, because of the lack of instruments and tools for the management and analysis of the territory, as well as low local capacities, in both public and private sectors, to carry away the evaluations of the plots and sites of projects, in which are defined, if the same gather the right conditions for the proposed developments, have contributed the increase in the incidence of landslide cases that affect the settlers of the district. Additionally and because of the lack of planning of the territory, whose foundation is the right identification of the land use and its characteristics, the inclusion of Risk Management and Climate Change Adaptation; possibilities are introduced that the population or the final consumer of this projects build vulnerabilities and they be affected by diverse hazards that put in risk even their own lives, besides the personal properties acquired throughout time and which are the product of their job. In these sense, the Central District Municipality has been a recent scenario of different landslide movement cases, which in a majority occur because of the inappropriate use of the territory (Because of lack of knowledge of it), because of the low institutional and national capacities in landslide movements topics, lack of regulation and vigilance, and other of different type that have been allowed. Cases like City of Angel Residence that compromised more than 17 millions of American Dollars investments in a housing project that led to the loss of the houses of at least 182 families, and others like the ones presented in the Nueva Santa Rosa, the Eden, Campo Cielo and, Jose Angel Ulloa colonies, etc., that affected an elevated number of population are examples of it.

### **THE DEVELOPMENT ACTIVITIES IMPLEMENTED**

Particularly in the case of landslide movement, after been severely affected by Hurricane Mitch, the Central District Municipality has been accompanied by the Japanese International Cooperation Agency

<sup>3</sup> The Inter-American Development Bank, in its recent Action Plan for Tegucigalpa y Comayagüela (development Plan undertaken by the Initiative of Emergent and sustainable Cities, ( initials in Spanish ICES-BID)



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

JICA, through the highly numerous significant contributions in Integral Management of Disaster Risk matter. The knowledge of risk generated through the strengthening of institutional capacities, which have gone together with the instruction of methodologies for the development of landslide movements inventories, strengthening of the monitoring capacities for landslide movements events, etc., which are some of the most significant results, however, giving steps to the institutionalization of the instruments, the creation of ordinance and with it secure the implementation of the land management, represent the major challenges to which the municipality works toward the construction of safer environment in the light of landslide movement hazards in the Central District metropolitan area. The stabilization of two of the most critical areas, affected by the gravitational process or removal of mass events, such as Berrinche and Reparto, are between others, two of the most outstanding interventions. However, even though of the development of mitigation works in the light of landslide movements from Berrinche and Reparto, have contributed fundamentally to safeguard the life of hundreds of settlers of the municipality, the participation of JICA has also allowed to generate experiences and strengthen the systematic and institutional capacities of the country, because due to the development of these engineering works, gave the inclusion to national and municipal technicians in the knowledge of science, techniques, and technologies implemented for Japan in attention to similar cases.

The Japanese Cooperation has also strengthen the communitarian response system, allowing to the municipality through the Emergency Municipal Committee (Initials in Spanish CODEM), to develop local structures under the implementation of the BOSAI Methodology, building a prevention culture and replicating the legacy of “Learning to live with Risk”.

### **PROJECT PRIORITIES**

From the municipal perspective, the management evolution of this type of phenomenon (landslide movement), has been manifested through the constant, highly active, progressive, and consistent dynamic with an integral process. Many of the accomplishments obtained have been the result of important contributions of the different cooperation bodies and authorities, being the one of greatest significance on landslide movements topics, the Japanese Cooperation Agency; who being interested in contribution to the municipality and communities, have accompanied us. However, its notable the necessity of the municipality to strengthen even more the technical entities for the decision-making based on the scientific-technical criteria, which after being integrated in the instruments and/or tools of analysis and land management, will let them develop a more complete analysis of the land management. This instruments and/or technical tools should be built with the purpose of becoming a legal instrument that allows developing land management activities, handling the risk to disasters and enabling the climate change adaptation.

The Japanese Cooperation has contributed to produce significant changes in the municipality, stimulating the implementation of procedures that include a vision about landslide movements risk and other menacing phenomena, improving our land management and reducing the risk to disasters, however, as a community we hope to give the next step, becoming self-managers to solutions in the light of these events. After being part of the different processes that JICA has undertaken in the country, particularly in Central District, arises through this project the consideration to potentiate the capacities generated by them, consequently it's proposed to generate tools and instruments of analysis and management for the definition of measures for intervention in the light of landslide movements. This tools and instruments should be developed through real attention dynamic processes, extracted during the development of undertaken actions for the integral boarding of selected cases, in a continuous and systematic process that gathers all the elements to generate solutions whose implementation can be valued as a reference of the effectiveness of the process. Meaning, that with this project, the construction of the instruments and tools for analysis and land management is proposed, product of a logical-sequential intervention, that will be the beginning to the characterization of events ( fault mechanism); continue with the definition of measures, the design of





**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

them, the generation of the tender books, execution, supervision, maintenance, etc., and finally will get to the zoning, generating modifications to the land use and its regulations by means of legal instruments such as municipal ordinance or commands of the SINAGER governing board.

It proposed to give continuity to the initiated processes by JICA since 2001 on its Master Plan “Study of Floods Control and Landslide Prevention in the Metropolitan Area of Tegucigalpa, Republic of Honduras”, in which 17 landslide areas interventions were priority and because of scientific-technical capacity and economic reasons, only Berrinche and Reparto have been attended. In this same study the defined priority is to attend the landslide movement sites located in the Nueva Santa Rosa, Eden and Campo Cielo colonies, for which and in result of the “Support to the strengthening and training of professional capacities in Mitigation and Control in the light of landslide movements in the Tegucigalpa Metropolitan Zone of Republic of Honduras Project, they’ve obtained a rich characterization product, besides the local technical capacities to replicate the experiences throughout the municipality, however, the development of countermeasures in the light of landslide movements in these sites, still remains a necessity every day more complex, mainly because of marginality and overcrowding <sup>4</sup>. In this sense, through this project is proposed to give continuation to the projects mentioned, undertaking processes for the definition and implementation of small and medium scale structural and nonstructural measures, to improve the stability of the proposed sites (Nueva Santa Rosa, Eden and Campo Cielo colonies), but at the same time, produce the tools and instruments that enable the Central District Municipality, subsequently of this project, to manage in an autonomous way its mitigation measures in the light of disasters for landslide movements events in the Central District Metropolitan area.

## **7.- OUTLINE OF THE T/C**

### **7.1) OVERALL GOAL (Long -Term Objective)**

Build local and national scientific -technical capacities based on the practical experience obtained with the accompaniment of the Japanese International Cooperation Agency (JICA), for the integral approach of the landslide movement events (Landslides and other gravitational process) through the cases that are developed in the Central District Metropolitan Area.

### **7.2) T/C PURPOSE (Objective expected to be achieved by the end of the project period. Elaborate with quantitative indicators if possible)**

1. Give continuity to the project “Assistance for Strengthening and Capacity Building of Professional techniques for the Control and Mitigation of Landslide in Tegucigalpa Metropolitan Area, Honduras Republic (JICA1E) / developing and executing the countermeasures in the face of Landslide movement events, in at least three sites of the Central District Municipality (Tentatively Eden o Bambu, Nueva Santa Rosa and Campo Cielo).
2. Build, adapt, and/ or modify tools and instruments of analysis and management of risks and territory oriented to the landslide movements phenomenon approach (Landslides and other gravitational process), which can be replicated or easily adapted for the implementation in the Metropolitan Areas of the Central American region. At least five documents of guides and/or

<sup>4</sup> Marginality and overcrowding: the lack of water and sanitation network, as well as other services such as communication routes in the right conditions and rainwater channeling, allow that because of the infiltration and runoff, the waters contribute significantly to the instability. In case of overcrowding, its important highlight that because of the difficulty to a access to a house and plots to build, contributes to the construction of new risks applying inappropriate materials and techniques with the purpose of maximizing the use of small plots of which they dispose, but at the same time, leading to concentrate an elevated amount of population to high susceptible to landslide movement areas.



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

manuals will be created for related topics to the characterization of landslide movement events, Management of structural and nonstructural mitigation measures in the light of landslide movements, the zoning and regulation of landslide movement affected areas, etc.

3. Generate and strengthen the institutional capacities of the AMDC, UNAH, and COPECO in Mitigation and Landslide Movements topics (Landslides and other gravitational process) applicable in the Metropolitan Areas. Increased the scientific and technical capacities of SINAGER by COPECO-CENICAC, with at least 20 prevention certified officials, through their participation in JICA’s developed processes with the execution of this project.
4. Develop technical tools for Analyzing and Management of the Mitigating measures in the face of Landslide movements (Landslides and other gravitational process) applicable in the Metropolitan Areas. A technical guide will be constructed for the characterization of the landslide movement events ensuring to get to the identification of fault mechanism and minimum design parameters; also a basic manual for structural countermeasure works in the light of landslide movements will have to be constructed. Finally, a general manual of maintenance for countermeasure works in the light of landslide movements will be made.
5. Develop technical tools oriented to the land management with focus on the Integral Management of Disaster Risk, but especially in the face of land movement applicable in the Metropolitan Areas. A criteria guide will be made for the zoning and regulation of affected areas by landslide movements, likewise, a revision guide for actualization on inventory of landslide movements, hazard maps, and susceptibilities in the light of landslide movements will be constructed, and that will be used for the revision and actualization of the local and national events.
6. Generate and strengthen the national systematic capacities on Mitigation and Landslide Movements topics (Landslides and other gravitational process) oriented to the Metropolitan Areas, specifically through the socialization of the instruments and tools generated with this project, likewise replicate the process in other urban and/or metropolitan sites of the country. The contribution to the SINAGER in the attention to at least one of their interest case that is affected by landslide movement events must be made.
7. Share the experiences and diffuse the generated instruments nationwide, regional and internationally. Develop at least dos workshops, local and national course and certificate, with the purpose to socialize the tools, instruments, and experiences obtained with this process, likewise a regional participation space will be generated for the sharing of the generated experiences, instruments and tools. Additionally, the search for international spaces will be made, seeking to identify where is possible the diffusion of the result of this project.

### 7.3) OUTPUTS

1. Strengthened the cooperation ties and technical-scientific collaboration between JICA and Honduras.
2. Strengthened the institutional coordination capacities between AMDC, UNAH, COPECO and JICA.
3. Extended and Strengthen the regional capacities with the use of the experience with generated by JICA 2E projects.
4. Generated and strengthened the institutional capacities of AMDC, UNAH, COPECO in the topics of landslide movement events.
5. Extended and strengthened the institutional capacities of AMDC, UNAH, and COPECO for the



**Project:**

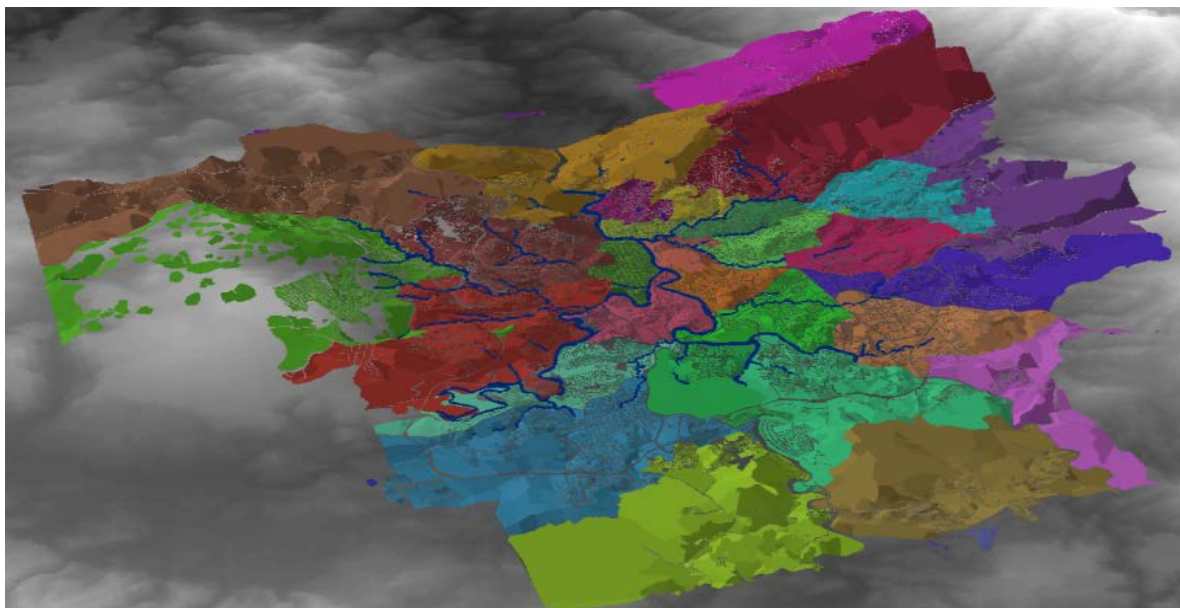
**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

investigation, evaluation, analysis, and determination of physical-mechanic characteristic in landslide movement events (Landslide and other gravitational processes).

6. Extended and strengthened the institutional capacities of AMDC, UNAH, and COPECO for the management of countermeasure in the light of Landslide movement events (Landslide and other gravitational processes).
7. Extended and strengthened the institutional capacities of AMDC, UNAH, and COPECO for the analysis and regulation of territory affected by landslide movement events (Landslide and other gravitational processes).
8. Generated and strengthened the national systemic capacities for the approach in landslide movement (Landslide and other gravitational processes) cases, through the participation of the multidisciplinary and institutional commission for the technical evaluation of housing projects in Central District.
9. Strengthened the technical-scientific regional ties about the themes of landslide movement events through the successful experiences interchange obtained with this project.

**7.4) T/C SITE (In case the proposed T/C assumes a particular area, please enter the mane of the target area for the T/C and attach a rough map to the document submitted, The attached map should be at a scale that clearly shows the Project site)**

The site were the activities of this project will be developed is referred to the Central District Municipality, which corresponds to the geographical area of the national territory were the capital city of the Republic of Honduras is located. Composed of two principal cities, Tegucigalpa and Comayagüela, which represent the municipality urban area. Likewise, its rural area is made up of by 41 villages and 293 hamlets. It belongs to the Department of Francisco Morazán, with a total area of 1,514 square kilometers and counts with at least 1,276,620 numbers of inhabitants<sup>5</sup>. Following is a schematic map of the location:



*Image Political Administrative Division of Metropolitan Area of Central District (Local scale)*

<sup>5</sup> Instituto Nacional de Estadística y Censo (INE)-2010



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**



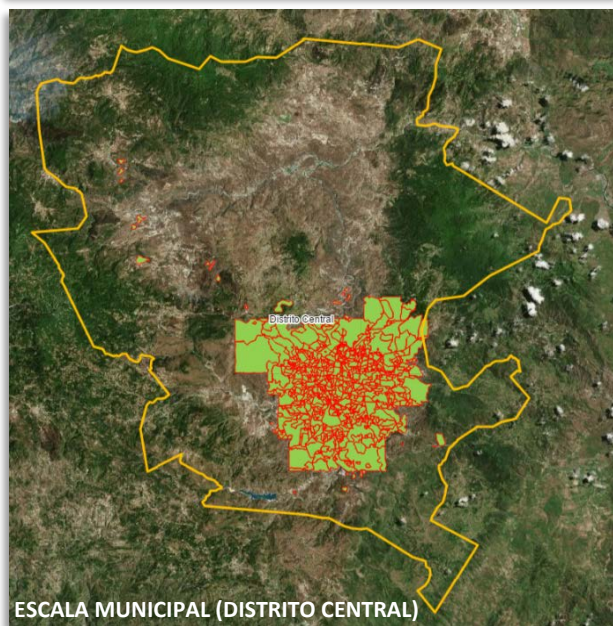
**ESCALA REGIONAL (CENTROAMERICA)**



**ESCALA NACIONAL (HONDURAS)**



**ESCALA LOCAL (TEGUCIGALPA Y COMAYAGUELA)**



**ESCALA MUNICIPAL (DISTRITO CENTRAL)**

*Schematic maps of the different regional, national, local and municipal area of the JICA 2E project were the implementation is proposed.*

**7.5) T/C Activities (Specific actions intended to produce each “Output” of T/C by effective use of the “Input”)**

**7.5.1) INVESTIGATION, ANALYSIS AND CHARACTERIZATION OF THE LANDSLIDE MOVEMENTS (LANDSLIDES AND OTHER GRAVITATIONAL PROCESS) APPLICABLE IN THE METROPOLITAN AREAS**

- a. Special studies oriented to the Metropolitan Areas affected by Landslide Movements (Landslides and other gravitational process)/ Investigation of Characteristics and Topographic Parameters, Geomorphological, Geological, Geotechnical, Geophysical, Hydrological, Hydrogeological, etc.,
- b. Review, Analysis, and Interpretation of data records obtained with the exploration.
- c. Analysis of Landslide Movement Hazard (Landslides and other gravitational process). This activity will be sent to the Final Characterization of the sites of interest.
- d. Analysis of the Vulnerability caused by Exposition to Landslide Movement (Landslides and other gravitational process) of the selected sites of interest for the development of the project.
- e. Risk Analysis associated to the exposition in the light of hazard of the sites of interest selected for the development of the project.



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

- f. Definition of design concepts for the works of the countermeasure in the light of landslide Movement (Landslides and other gravitational process) proposed as mitigation measure or stabilization of the selected interest sites for the development of the project.
- g. Development of the Evaluation Guide Analysis and Characterization of the Hazard in the face of landslide movement (Landslides and other gravitational process) applicable to Metropolitan Areas

**7.5.2 COUNTERMEASURES MANAGEMENT IN THE LIGHT OF LANDSLIDE MOVEMENTS (LANDSLIDES AND OTHER GRAVITATIONAL PROCESS) APPLICABLE IN THE METROPOLITAN AREAS**

- a. Monitoring of the Parameters and topographical, Geotechnical, Geophysical, Hydrological, and Hydrogeological characteristics necessary for the design development of countermeasure works.
- b. Design of the Countermeasure Works in the face of Landslide Movements (Landslides and other gravitational process) oriented to Metropolitan Areas. The activity includes the development calculus design specifications and implemented methods.
- c. Technical specifications, quantity, and estimated budget of the proposed works.
- d. Elaboration of the tender books.
- e. Execution and monitoring (Inspectorate, supervision and reception of the works).
- f. Development of the Design Manual of Countermeasure Works in the light of Landslide Movements (Landslides and other gravitational process) in Metropolitan Areas
- g. Development of the Maintenance Manual for the Implemented Countermeasure Works that will be implemented as a result of the intervention of this project.

**7.5.3 MANAGEMENT OF THE MEASURES IN LAND MANAGEMENT ORIENTED TO THE LANDSLIDE MOVEMENT ZONES (LANDSLIDES AND OTHER GRAVITATIONAL PROCESS) APPLICABLE IN THE METROPOLITAN AREAS**

- a. Accompaniment in the activities to develop, Equipment and Implementation of the SIMRET-DC (Integrated Only Risk Information Center)
- b. Creation, development and Implementation of the Municipal Monitoring Network in the light of Landslide Movements (Landslides and other gravitational process)
- c. Creation, development and Implementation of the communal SAT (Early Warning Systems, initials in Spanish) (JICA-BOSAI) in the light of landslide movements. For it, it's estimated the use of provided information that will be created by the Municipal Monitoring Network in the light of Landslide Movements.
- d. Creation of the Revision and actualization Guide for Vulnerability Maps and Hazard Inventory Landslide Movement (Landslides and other gravitational process) in the Metropolitan Area.
- e. Creation of the Methodological Guide for the Zoning of the Metropolitan Area affected by Landslide Movement (Landslides and other gravitational process)/ Definition and establishment of the technical zoning Criteria.
- f. Construction of the Proposal for the Municipal Ordinance of Zoning for the Metropolitan Area affected by Landslides (Landslides and other gravitational process), which lead to the proper planning of land use and the Spatial Planning.

**7.5.4 STRENGTHENING OF THE CAPACITIES AND NATIONAL AND INTERNATIONAL INTERCHANGE**

- a. National and International level training of municipal technicians, university graduates and state actors about the methodologies for the development of the project components.



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

- b. Accompaniment in the process of strengthening the communal capacities through the intervention of the BOSAI Project (COPECO, AMDC, JICA, incorporating, UPN-FM and UNAH).
- c. Equipment and instrumentation strengthening oriented to complement the interventions of each component.
- d. Elevate to governing board of SINAGER the developed tools and instruments, ensuring its formalization for national use.
- e. Course/Workshop at national and Centro American level for the Implementation of the Evaluation, Analysis and Characterization of Hazard by Landslides (Landslides and other gravitational process) in the Metropolitan Areas Guide.
- f. Course/Workshop at national and Centro American level for the Implementation of the Design Manual of Countermeasure Works in the light of Landslide Movements (Landslides and other gravitational process) for Metropolitan Areas.
- g. Course/Workshop at national and Centro American level for the Implementation of the Revision and actualization Guide of the Vulnerability Maps and Hazard Inventory Landslide Movement (Landslides and other gravitational process) applied in Metropolitan Areas.
- h. Course/Workshop at national and Centro American level for the Implementation of Methodological Guide for the Zoning of the Metropolitan Area affected by Landslide Movement (Landslides and other gravitational process)
- i. Diploma at national and centro American level on “Gravitational Processes and their Impact on Spatial Planning of Metropolitan Areas”
- j. Others:
  - o Experience Interchange with JICA Central Tokyo (Japan)
  - o National Congress
  - o Central American Congress
  - o Regional interchange Visits
  - o Interchange between national and regional Universities
  - o Interchange and/or internship between Capital Cities (Iber-American Capital Cities Union initials in Spanish UCCI)
  - o Regional events sponsored by the Coordination Center for Prevention of Natural Disasters in Central America (initials in Spanish CEPREDENAC)
  - o Regional Conferences through the national entities of Risk to Disaster Integral Management (Initials in Spanish GIRD) of Central America.
  - o Virtual Courses or Trainings through various platforms
  - o International Consortium on Landslides (ICL)
  - o Etc.

#### **7.5.5 JICA 2E PROJECT SYSTEMATIZATION**

- a. Consolidated Accompaniment, register and synthesis of the processes, results and lesson obtained with the execution of JICA 2E project.

#### **7.6 INPUT FROM THE RECIPIENT GOVERNMENT [Counterpart personnel (identify the name and position of the Project manager), support staff, office space, running expenses, vehicles, equipment, etc.]**

- a. The Project will be led from the Municipal Central District Municipal Office (initials in Spanish AMDC), through Mayor’s Office, whom with the assistance of the Integral Risk Management Municipal Unit (Initials in Spanish UMGIR-AMDC), will guaranty the effective development and implantation of JICA 2E Project, under the coordination of the



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

participation and collaboration of the rest of counterparts [Permanent Contingencies Commission (initials in Spanish COPECO), Autonomous National University of Honduras (initials in Spanish UNAH), and JICA].

- b. Local-technical Counterparts assignment for the assistance and accompaniment of each of the Japanese experts. The AMDC will include the participation of the municipal technicians and professionals with higher experience in the evaluation and attention to events of landslide movements' cases, being between them personnel from the Risk Evaluation Management, Municipal Emergency Committee (Initials in Spanish CODEM-AMDC), UMGIR-AMDC and other that are required. Likewise, from COPECO, if it's considered and required, will include the assistance of hired technicians and specialists from the institutional strengthening project obtained from World Bank and Inter-American Development Bank (initials in Spanish BID). Finally, from the UNAH will be assigned personnel of Science of the Earth Honduran Institute (initials in Spanish IHCIT).
- c. Assignment and availability of equipment and instruments for the analysis, exploration and recording of the physical-mechanical soil characteristics, that are available in the AMDC, COPECO and UNAH institutions, likewise any other within the framework of SINAGER, that can be handled with the other institutional entities. Within the equipment highlights the soil radar, landslide scanner, electrical and seismic refraction equipment, cone penetration testing (CPT) equipment, structural scanner, remote sensing for recording the angle and structural crack monitoring (potentiometer, structural inclinometers, accelerometer, etc.), other that the country has available.
- d. Local professionals' accompaniment that is required and form part of the institutions of COPECO and UNAH personnel.
- e. Assignment of necessary resources according to the municipal availability for the execution of the project.
- f. Assignment of necessary resources that according to COPECO's availability can be incorporated to the execution of the project.
- g. Availability of all the equipment and instruments from UNAH, likewise of all the generated and/ or strengthened capacities part of the "Assistance for Strengthening and Capacity Building of Professional techniques on Control and Mitigation in the light of Landslide in Tegucigalpa Metropolitan Area, Republic of Honduras (JICA1E)
- h. Logistic accompaniment for the field visits 'development or other in framework of the project that are required, as well as immediate response equipment that will be available from CODEM-AMDC and from COPECO, to attend the Japanese personnel experts.
- i. Office space assignment properly adapted and conditioned for the Japanese experts use.
- j. Municipal Police protection and safeguard during every one of the field visits or any moment that is required by the Japanese experts.

**7.7 INPUT FROM THE JAPANESE GOVERNMENT (Number and qualification of Japanese experts/consultants, contents of training in Japan and in-country) courses, seminars and workshops, equipment, etc.**

- a. Experts in specific areas of Science and Knowledge, with a high capacity to transfer knowledge and coordinated job with multidisciplinary heterogeneous group, preferably with experience on development of projects in Central America
  - A. Group Leader/ Specialized in characterization and evaluation of landslide movement events, with coordination capacities of multidisciplinary trained and intersectional representation



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

heterogeneous groups

- B. Geologist with wide experience on investigation, evaluation and characterization of landslide movement events, preferably with local and/ or regional geology knowledge.
  - C. Geomorphologists with wide experience on investigation, evaluation and characterization of landslide movement events, preferably with local and/ or regional typical geomorphology knowledge.
  - D. Experienced Geophysicist on exploration in landslide movement affected areas; preferably in high densification sites of urban areas (experience on identifying of events originates by mankind such as broken pipes, waste water infiltration, lack of drainage systems, etc.)
  - E. Geotechnician with experience on analysis and study of landslide movement events (including monitoring, development and implementation of SAT in the light of landslide movements), with additional experience on the development of small, medium and large scale countermeasure works in the light of landslide movements.
  - F. Hydro geologist with wide experience on investigation, evaluation and characterization of landslide movement events, preferably with local and/ or regional typical hydrogeology knowledge.
  - G. Specialist in design and execution of countermeasure works in the light of landslide movements with experience on investigation, development of characterization studies, development of countermeasure designs in the light of landslide, collapse, rock and block fall, debris flows, sludge flows, soil creeping, etc.
  - H. Specialist in zoning and land management with experience in the development of regulation processes and/ or creation of laws oriented to attending cases in landslide movements affected areas.
  - I. Specialist in the creation of monitoring networks or systems for vigilance, observation and implementation of Early System Alert in the light of landslide movements.
  - J. Specialist in maps and digitization of geotechnical, geophysical, geological, hydrogeological, geomorphological information. That has participated before in other project evaluations, investigations, characterizations, stabilization of landslide movements' events.
  - K. Specialist in building local capacities who's able to generate and transmit the obtained knowledge from the generated experience on the project.
  - L. Legal specialist with experience on landslide movement cases that have affected high densification populated areas.
  - M. Specialist in systematization with experience on landslide movement cases.
- b. Project cooperation period: 42 to 60 months.
  - c. Necessary equipment for the Project implementation: Within them area the high accuracy special data collection equipment, with high resolution images (unmanned autonomous airborne equipment, drones), geophysical and geotechnical exploration equipment with sample recovery, remote sensing monitoring of landslide movement events, special equipment for the evaluation, analysis and characterization of events (total station, GPS, differential submeters, distance meter, stereoscopes, etc.), software for analysis and post processing data, hardware for the implementation and use of the software, etc.
  - d. Counterpart training program in Japan: Mostly in topics of 1) Geotechnical and geophysical exploration for the designs of countermeasure structural works in the light of landslide movements, 2) Design of structural countermeasure works in the light of landslide movements





**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

(Design methodologies). 3) Monitoring Networks for landslide movement control. 4) Early Alert Systems in the light of landslide movement events, and finally 5) Japanese experiences in land management (land use and advantage, likewise its restrictions and regulations)

- e. Funding for the execution of the designed countermeasure works resulting from the implementation of the JICA 2E project. Through which the sites can be stabilized and at the same time will generate the activities to the building of tools and instruments.

**8.- IMPLEMENTATION SCHEDULE**

Beginning: June of 2017

Ending: January of 2021

Estimated execution: 42 months (minimum term)

**9.- DESCRIPTION OF IMPLEMENTING AGENCY**

**9.1. - (Budget allocated to the Agency, number of staff of the Agency, Department/ Division in charge of the T/C, etc.)**

The executing agency will be the **Central District Municipal Office (initials in Spanish AMDC)**, whom through the Mayor’s Office with the assistance of the Integral Risk Management Municipal Unit (Initials in Spanish UMGIR-AMDC), will coordinate the development and fulfillment of each and all of the programmed activities through this project.

**9.2.- (If implementing agency plans to take some (future) actions in connection with this proposed project please describe the concrete plans/action and enter the funding sources for the plans and actions.)**

- a. It’s expected the municipal adoption by means of the institutionalization of all the tools and instruments generated by this project, allowing through them to generate specific regulation frameworks for the administration of the Central District land.
- b. It’s expected with this Project to replicate the generated experience, in the numerous identified affected sites by landslide movement events on Central District Municipality, directing from UMGIR-AMDC, strategies and policies of boarding oriented to the reduction of risk of disasters and the climate change adaption.
- c. The Central District Municipality with the generated and strengthened capacities by this project (knowledge, equipment, instruments, tools, etc.), will undertake institutional actions aimed to the consolidation of internal procedures that allow to generate control, prospects and indicators to improve the land administration and measure the impacts in reduction of risks to disasters, considering for it the inclusion of the climate change effects.
- d. The Central District Municipality will accompany the execution of this project, with the funding and development of small scale works that are oriented to complement the medium and large scale works defined and identified by this project, which JICA 2E will finance as a solution to the mitigation and stabilization of affected areas by landslide movements in sites of interest.

**10. RELATED INFORMATION**

**10.1.- (Prospects of further plans and actions/ expected funding resources for the project)**

- a. The Central District Municipality may broaden its participation in the execution of this project,



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

with the funding and development of additional works that are oriented to complete the defined and financed by JICA 2E for this project.

- b. The Central District Municipality foresees to generate synergies between this project and other municipal initiatives that are oriented to reducing the risk to disasters and the climate change adaptation, specifically in landslide movement themes, as well as to the land use regulation and land management.
- c. At municipal and national level, such for the Central District Municipality Office (AMDC) as for the Permanent Contingencies Commission (COPECO), exists the perspective to strengthen the local and national capacities as a systematic effort in which allows the development of tools and instruments that can be elevated to the SINAGER governing board, and with it generate national regulatory actions for landslide movement management and land management of the affected territory.
- d. It is expected to have the possibility of using all information and data available to the region and are generated through the Global Facility for Disaster Reduction and Recovery (GFDRR)
- e. It is expected to have the possibility to use the information and data as well as World Bank support, specifically h
- f. Through its programmes oriented to Climate Change and Early Warning System
- g. It is expected for the possibility of having the support of the Inter-American Development Bank (IDB) with financing to countermeasures works under this project are designed and required execution.

**10.2.- Activities in the sector by the other donor agencies, the recipient government and NGOs and others:**

The Central District Municipality Office (AMDC) through this section lets the Japanese Cooperation know the following:

- a. The AMDC hasn't made any other action or request of formal support directed to any other external cooperation entity, which is related with the JICA 2E Project.
- b. The AMDC presents the development of a Project that give continuity to the results obtained by JICA on its previous projects: 1) Master Plan “Study of Floods Control and Landslide Prevention in the Metropolitan Area of Tegucigalpa, Republic of Honduras, and 2) Assistance for Strengthening and Capacity Building of Professional techniques for the Control and Mitigation of Landslide in the Metropolitan Area of Tegucigalpa, Republic of Honduras.
- c. The AMDC, specifically dealing with landslide movement events, currently doesn't have any funding, support or collaboration of any national or international nature, or country friends or others that have been defined to accompany the municipal efforts for the attention to this problematic.
- d. The AMDC requested the development of this project as a continuity to the former projects that were accompanied by JICA in the Central District (mentioned in subsection b of this part), seeking to use the obtained results, through the integration of them in the construction of the final solutions that allow to close the attention cycles and interventions initiated by JICA. Likewise, taking from this process the necessary contents and experiences generating the tools and instruments that will lead to a generation land use laws and regulations affected by landslide movement events, as a part of to land management municipal actions focused to climate change adaption. According to what is described, it's important to point out that the former projects have represented highly significant contributions to the community of Central District, which have substantially strengthened our technical and scientific capacities, with technology transfer



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

and other contributions, however, it's important to the municipality to generate greater capacities to self-manage the attention to this events and its solutions, therefore, this project seeks to follow-up and continue JICA's previous initiatives, which making use of all the products and results, but extending the range to the generation of local capacities to self-manage the landslide movements events, will propitiate and enable the undertaking actions leaning to the territory planning with land management measures under the focus of climate change adaptation.

- e. The AMDC wants the Japanese Cooperation to know, that their exists different previous studies on landslide movement matter, and that most of them, undertaken with the support of the Japanese Cooperation in the years of 2001-2001, 2007-2011, 2012-2013, and finally 2014-2016. Additionally, in 2011 the United Nations Development Programme (UNDP) generated studies that gave place to the creation of the multi-hazard map (map of the susceptibility analysis in the light of landslide movement in the Central District urban area), and in 2014 the Inter-American Development Bank (IDB), through the Emerging and sustainable cities initiative made a new susceptibility analysis in the light of landslide movement, which is still not official.

**11. Global Issues (Gender, Poverty, Climate change, etc.).**

**11.1. - (Any relevant information of the project from global issues (Gender, Poverty, Climate change, etc.) perspective.**

- a. Honduras is the most affected country in the world in the light of Extreme Climate Events, according to table of the ten most affected Countries since 1994 to 2013 (annual average), with a 10.33 score on the Long Term Climate Risk Ranking (CRI)<sup>6</sup>.
- b. The Central District holds between its geographical limits the most important city of the country, its political- administrative capital, Tegucigalpa.
- c. At least 11% of the Central District population is least 11% of the population is settled in high risk land in the light of landslide movements and floods. In these sense, the estimated annual loss for Central District as a consequence of disasters and damages originated by the effects of natural events are equivalent to \$105 millions of American Dollars a year<sup>7</sup>.
- d. On Municipal Statistics, in 2016, 156 Slums and/ or colonies are located in risk places, with at least 350,000 people exposed to live in them.
- e. In the country, of an estimated population of 8,576,532 inhabitants, almost six millions of the people are poor (5,892,077). In percentage, a 68.70% of the population is found in poor conditions, however, a 44.70% of the population is found in extremely poor conditions, according to the National Statistics Institute in the year 2015.
- f. From the total of the Central District Population. (1,276,620 inhabitants), at least 435,000 citizens live in relatively poor conditions and other 82,650 in extremely poor conditions, represented this in percentage figures, around 35% in relatively poor conditions and 6.5% in extremely poor conditions. According to the National Statistics Institute in the year 2015.
- g. Particularly for the Central District, in general terms, is estimated that in the total national population, 47.86% are men and 52.13% are women. According to the National Statistics Institute in

<sup>6</sup> Germanwatch

<sup>7</sup> The Inter-American Development Bank, in its recent Action Plan for Tegucigalpa y Comayagüela (development Plan undertaken by the of Emerging and sustainable Cities Initiative



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

the year 2015.

**12. Environmental and Social Considerations.**

**12.1.- (In case of technical cooperation project/ Technical Cooperation for Development Planning, Please Fill in the attached screening format).**

Note: If JICA considers that the environmental and social considerations for the project of technical cooperation be disclose, the applicants must agree on it, allowing the public audience according to JICA’s guideline for the environmental and social considerations, just as indicated in question number 11 in attached screening format.

- a. The project is oriented to the Technical Cooperation for the development request, so the attached screening format will be completed.

**12. - Others.**

The institutional counterparts’ participation of the country in this project has been defined by the understanding agreements framework between the Central District Municipality Office (AMDC) and the Science of the Earth Honduran Institute of the Autonomous National University of Honduras (IHCIT-UNAH) in 2016, likewise, through the inter-institutional Cooperation Agreement between the ADMC and the Permanent Contingencies Commission (COPECO) in 2014. However, having sharing interests for generating local and national tools and instruments, that will allow to improve the methods and procedures for managing landslide movement events, we have undertaken the joint process of formulation and development of this proposal.

Signed:	
Title:	Alcalde Municipal del Distrito Central
On behalf of the Government of:	Alcaldia Municipal del Distrito Central
Date:	



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

**Screening Format (Environmental and Social Considerations)**

Please write “to be advised (TBA)” when the details of a project are yet to be determined.

Question 1: Address of project site

Question 2: Scale and contents of the project (approximate area, facilities area, production, electricity generated, etc.)

2-1. Project profile (scale and contents)

2-2. How was the necessity of the project confirmed?

Is the project consistent with the higher program/policy?

YES: Please describe the higher program/policy.

( )

NO

2-3. Did the proponent consider alternatives before this request?

YES: Please describe outline of the alternatives

( )

NO

2-4. Did the proponent implement meetings with the related stakeholders before this request?

Implemented       Not implemented

If implemented, please mark the following stakeholders.

Administrative body

Local residents

NGO

Others ( )

Question 3:

Is the project a new one or an ongoing one? In the case of an ongoing project, have you received strong complaints or other comments from local residents?

New    Ongoing (with complaints)    Ongoing (without complaints)

Other

[ ]



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

**Question 4:**

Is an Environmental Impact Assessment (EIA), including an Initial Environmental Examination (IEE) Is, required for the project according to a law or guidelines of a host country? If yes, is EIA implemented or planned? If necessary, please fill in the reason why EIA is required.

Necessity (Implemented Ongoing/planning)

(Reason why EIA is required: \_\_\_\_\_ )

Not necessary

Other (please explain)

**Question 5:**

In the case that steps were taken for an EIA, was the EIA approved by the relevant laws of the host country? If yes, please note the date of approval and the competent authority.

<input checked="" type="checkbox"/> Approved without a supplementary condition	<input type="checkbox"/> Approved with a supplementary condition	<input type="checkbox"/> Under appraisal
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(Date of approval: \_\_\_\_\_ Competent authority: \_\_\_\_\_ )

Under implementation

Appraisal process not yet started

Other ( \_\_\_\_\_ )

**Question 6:**

If the project requires a certificate regarding the environment and society other than an EIA, please indicate the title of said certificate. Was it approved?

Already certified

Title of the certificate: ( \_\_\_\_\_ )

Requires a certificate but not yet approved

Not required

Other

( \_\_\_\_\_ )



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

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Question 7:

Are any of the following areas present either inside or surrounding the project site?

Yes       No

If yes, please mark the corresponding items.

- National parks, protection areas designated by the government (coastline, wetlands, reserved area for ethnic or indigenous people, cultural heritage)
- Primeval forests, tropical natural forests
- Ecologically important habitats (coral reefs, mangrove wetlands, tidal flats, etc.)
- Habitats of endangered species for which protection is required under local laws and/or international treaties
- Areas that run the risk of a large scale increase in soil salinity or soil erosion
- Remarkable desertification areas
- Areas with special values from an archaeological, historical, and/or cultural points of view
- Habitats of minorities, indigenous people, or nomadic people with a traditional lifestyle, or areas with special social value

Question 8:

Does the project include any of the following items?

Yes       No

If yes, please mark the appropriate items.

- Involuntary resettlement (scale: households persons)
- Groundwater pumping (scale: m<sup>3</sup>/year)
- Land reclamation, land development, and/or land-clearing (scale:                      hectares)



**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

Logging (scale: hectares)

**Question 9:**

Please mark related environmental and social impacts, and describe their outlines.

- |  |   |
|--|---|
| <input type="checkbox"/> Air pollution         | <input type="checkbox"/> Involuntary resettlement   |
| <input type="checkbox"/> Water pollution       | <input type="checkbox"/> Local economies, such as employment, livelihood, etc.                                    |
| <input type="checkbox"/> Soil pollution        | <input type="checkbox"/> Land use and utilization of local resources  |
| <input type="checkbox"/> Waste                 | <input type="checkbox"/> Social institutions such as social infrastructure and local decision-making institutions |
| <input type="checkbox"/> Noise and vibrations  | <input type="checkbox"/> Existing social infrastructures and services   |
| <input type="checkbox"/> Ground subsidence     | <input type="checkbox"/> Poor, indigenous, or ethnic people   |
| <input type="checkbox"/> Offensive odors       | <input type="checkbox"/> Misdistribution of benefits and damages  |
| <input type="checkbox"/> Geographical features | <input type="checkbox"/> Local conflicts of interest  |
| <input type="checkbox"/> Bottom sediment       | <input type="checkbox"/> Gender   |
| <input type="checkbox"/> Biota and ecosystems  | <input type="checkbox"/> Children’s rights  |
| <input type="checkbox"/> Water usage           | <input type="checkbox"/> Cultural heritage  |
| <input type="checkbox"/> Accidents             | <input type="checkbox"/> Infectious diseases such as HIV/AIDS   |
| <input type="checkbox"/> Global warming        | <input type="checkbox"/> Other ( )  |

**Outline of related impact:**

( )

**Question 10:**

In the case of a loan project such as a two-step loan or a sector loan, can sub-projects be specified at the present time?

- Yes                       No

**Question 11:**





**Project:**

**“Mitigation Measures for Management In the light of Disasters by Landslides Movement Events in the Metropolitan Area Of Central District, JICA 2e”**

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Regarding information disclosure and meetings with stakeholders, if JICA’s environmental and social considerations are required, does the proponent agree to information disclosure and meetings with stakeholders through these guidelines?

Yes

No